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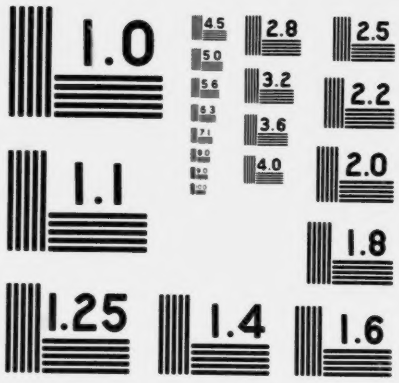
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By-Fredrickson, Clifford T.

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This handbook, written specially for the San Diego Public School System, contains detailed discussions on first aid, good laboratory practices, safety in the laboratory, and laws regulating the care and use of animals. The section on "First Aid" presents, in addition to standard first aid information, a discussion of first-aid kits for field trips and of a county-wide in-service First Aid Training Program. A section on "Laboratory Practices and Safety" contains information on procedures in several types of science laboratory and classroom situations for each of the major science subject matter areas. A special appendix of equipment lists is also included. (BC)

Stock No. 41-L-0500

First Aid

Handbook of SCIENCE LABORATORY PRACTICES AND SAFETY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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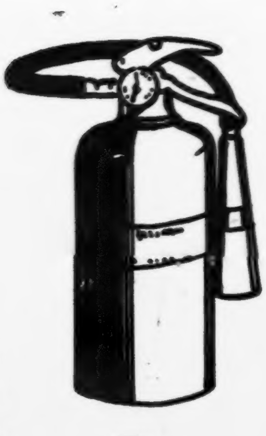
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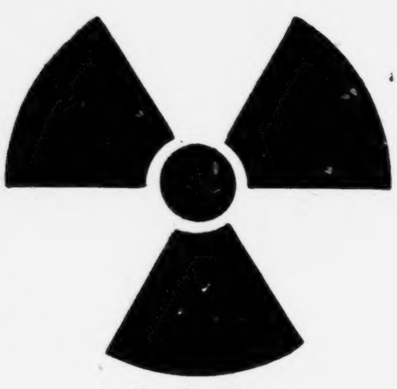
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Eye Safety

Poison

SE005 583

SAN DIEGO CITY SCHOOLS
SAN DIEGO, CALIFORNIA
1966

HANDBOOK OF
SCIENCE LABORATORY PRACTICES AND SAFETY

Prepared in 1959
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San Diego City Schools
San Diego, California
1966 Revision
Unedited

PREFACE

This publication is the second revision of the guide to laboratory practices and safety which was produced originally in 1959.

The main purpose of the handbook is to point out some of the hazards to health and safety which are inherent in science instruction in the secondary schools. Awareness of these hazards, avoidance of unnecessary danger, exercise of reasonable safety precautions, and the performance of prompt and efficient action in case of emergency are important elements of responsibility of the teacher. Information concerning vivisection and the care and use of animals in the classroom is also included. Science teachers should be familiar with the general information in the handbook as well as that which pertains specifically to the subjects which they teach.

Users of the handbook are encouraged to send criticisms or suggestions for improvement of this publication to the Curriculum Services Division Specialist in Science Education.

Wm. H. Stegeman

William H. Stegeman
Assistant Superintendent
Curriculum Services Division

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PHILOSOPHY FOR LABORATORY EXPERIENCES

The laboratory phase of any science course is an integral part of the course. It is one of the most important means of developing in students an understanding and appreciation of the particular field of science. The objectives of a laboratory exercise extend well beyond the learning of factual information. The philosophy of the science laboratory is well stated in the following excerpt taken from Science in General Education:

> "The value of problem solving through laboratory work in the school does not lie in the factual knowledge that may result from it but in the attitudes and habits of reflective thinking it encourages and in the understanding it gives of how the knowledge of science gained by the student from description was attained in the first place."

The facilities of the laboratory should be utilized whenever it best fits the instructional needs of the class. Laboratory experiences may range from a simple five-minute demonstration to individual student investigations extending over several days. Student participation in planning and conducting investigations is recognized as a uniquely valuable learning experience and is encouraged whenever it will fit smoothly and logically into the instructional plan.

Safety is a major consideration in a science laboratory. It is not only important that students be instructed in techniques of laboratory safety, but also that they be given the opportunity to demonstrate their knowledge of the proper safety practices.

Method of Conducting Laboratory Experiments

The type of laboratory experience used by the teacher will depend upon many factors: equipment and supplies, skill required to perform, adequacy of the laboratory, maturity of the students, and so forth. The following methods of conducting a laboratory experience are the most common:

Teacher demonstration

A laboratory experience is conducted entirely by the teacher for observation by the class. The conclusion may be discussed solely by the teacher, may be made part of a teacher-class discussion, or may be left to the individual student and his resources.

Teacher-student demonstration

A laboratory experience is conducted jointly by the teacher and one or more students for observation by the class. The teacher and demonstrating students may describe the experiment and its inferences for the class or let the individual members of the class draw their own conclusion, either written or orally.

Student demonstration

A laboratory experience is conducted by one or more students for observation by the class. The participating students are responsible to the class for the explanation of the phenomena being demonstrated.

Student-performed experiment

A laboratory experience by the individual student alone or in partnership with several other students is performed. Each student is responsible for both the technique and scientific understanding derived from the experience.

STRUCTURING THE LABORATORY INVESTIGATION

Regardless of the type of experimental procedure, it is most important that the student be aware of how the experiment relates to the material being studied and that he have a clear understanding of his participation. Some investigations may be highly structured, with complete directions for their successful completion and key statements or other aids provided to assist in understanding. Experiences of this type are referred to as closed-end experiments. At the other extreme are the open-end experiments, where the student is given only broad directions and he is to draw his own conclusions.

The literature of recent years has been critical of the structured experiment, referring to it as "cookbook laboratory," the inference being that through structuring the experiment the natural curiosity and intellect of the student is stifled. It is important that we not inhibit the curiosity and intellect of the student by over-structuring, but it is also important that the student be given the security and confidence of knowing what he is to do.

One of the goals of laboratory instruction should be to have students progress in such a manner that the degree of structuring can be reduced and the student can eventually perform open-end experiments. This goal is not attainable for all students or all classes. Several factors must be considered in determining the degree to which progress may be made toward open-end experiments. The maturity of the class is a significant factor. Generally the more immature groups, those in Science 8th, General Science 1-2, Basic Biology 1-2, and Science Problems 1-2, will need considerable structuring. In many instances the maturity of the class will permit very little progress toward open-end activity. Students in General Science 1-2 (8th), General Science 3-4 and Biology 1-2, will need considerable initial structuring but generally will make greater progress toward the open-end experiment.

Students in Advanced Biology 1-2, Chemistry 1-2, Physiology 1-2, and Physics 1-2, will also need initial structuring but should be able to progress to some limited open-end experiences. In Advanced Chemistry 1-2, and Honors Physics 1-2, the students should be able to progress readily into those experiences with limited structuring. Before the end of the course, some open-end investigations should be performed. The use of student project rooms is encouraged.

The maturity of the student will be a factor in determining the extent to which he can progress toward open-end experiments. If students exhibit maturity beyond the average for the group, there is no reason why they cannot be permitted to work on less structured experiments requiring facility and insight. There may be students in a laboratory class who will require the security of a structured, laboratory manual-type experiment during the entire course. It is better that the individual differences in students be considered than to have some confused and others thwarted by forcing all to progress at the same rate.

Teacher background and experience will in some cases limit the extent to which a class may progress toward the open-end experiments. It is not an easy task for a teacher to direct a laboratory where students of differing levels of maturity are performing different activities, each requiring materials and different degrees of structuring. The teacher should feel confident in the operation of his laboratory before progressing to more complex activities.

THE LABORATORY SCIENCE CURRICULUM

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THE LABORATORY SCIENCE CURRICULUM

Science classes in the secondary schools can be classified on the basis of the extent and quality of student laboratory participation. In Basic Biology, Biology, Advanced Biology, Physiology, Chemistry, Advanced Chemistry, Physics, and Honors Physics, regular laboratory experiences are an integral part of the instructional program. It is mandatory that students be provided the opportunity to conduct the investigations that are significant to the understandings of the course. It is expected that the laboratory work will be evaluated and be a factor in grading the student.

In the courses General Science 1-2 (8th) and General Science 3-4 it is expected that students will be given some opportunity to have firsthand laboratory experiences. The number of experiences will be less than for those courses identified in the above paragraph. In addition, the class should be structured so they will participate in student group demonstrations as well as observe teacher demonstrations.

In Science 8th, General Science 1-2, and Science Problems 1-2, teacher demonstrations and student demonstrations will be the most usual laboratory experience, but teachers are encouraged to involve all students as much as the laboratory equipment and the nature of the experience permits.

LABORATORY COURSES IN THE JUNIOR HIGH SCHOOL

Science 8th

Science 8th is an introductory course and explores, in one semester, scientific method, geology, astronomy and the life sciences. Because of the maturity of the students and the limited facilities, experiments are predominantly teacher demonstrations. Whenever possible, students should aid in these demonstrations and teachers should devise some investigations for the involvement of all students.

It is expected that the student will be able to draw some conclusions from the activities observed. Generally, the student write-up of the experiments will require considerable structuring by the teacher.

General Science 1-2

This elective course, offered in the ninth and tenth grades, builds on the knowledge and understanding gained in Science 8th. The course explores in greater depth the field of biology and includes more of the physical sciences. General Science 1-2 (8th) is available to selected able and interested eighth-grade students.

It is expected that the student will observe and participate in experiments requiring that simple conclusions be drawn and that the write-up give evidence of understanding the scientific method.

The student, through observation and experience, will begin to understand the use of laboratory equipment and supplies.

Here also, because of the limitations of the junior high school science classroom, most of the laboratory activities will be teacher demonstrations and student demonstrations. This will be followed by the student description of the purpose, technique and results of the experiment.

Whenever appropriate the students, especially in General Science 1-2 (8th), should perform individual investigations and be encouraged to do project work.

General Science 3-4

This is an elective for selected able and interested ninth-grade students. The course builds on the knowledge and attitudes gained in General Science 1-2. General Science 3-4 is a prerequisite to Advanced Biology and Advanced Chemistry.

General Science 3 is designed to give the student general and specific experience in the life sciences. The student will study several areas of biology, and will specialize in certain specifics. He will thus be prepared for further studies in science and will be prepared to take advantage of the advanced work offered in high school.

The students will gain some degree of competence in the use of dissection tools and the microscope.

General Science 4 is devoted to principles of elementary chemistry. Units include properties of matter, gas laws, water and solutions, structure of matter, chemical reactions and calculations, acids, bases, salts, and compounds of carbon.

The student will observe and participate in investigations that will aid his understanding of chemical principles.

The limitations of the junior high science classrooms will often prevent extensive individual experimentation. Facilities are available for groups of students to work together on experiments.

It is expected that students will gain insights and understanding of the principles and properties being shown by demonstration. Knowledge of good scientific procedures will be gained by student participation in statement of problem, design of experiment, observation and recording of results, analysis of data, and statement of conclusions. Participation of students in individual projects should be encouraged.

LABORATORY COURSES IN THE SENIOR HIGH SCHOOL

General Science 1-2 (See Laboratory Courses in the Junior High School)

Basic Biology 1-2

This is an elective laboratory course in life science for interested students of less than average ability level who would normally not succeed in regular biology classes. Procedures and materials used are those developed by the Biological Sciences Curriculum Study Special Materials Program.

Biology 1-2

This elective course is generally taken in grade 10. Emphasis is placed on the use of the laboratory in learning biological principles. Biological Sciences Curriculum Study Materials are used.

Advanced Biology 1-2

This course uses the biochemical approach to teaching biology, and builds on the learnings of General Science 3. There should be adequate provision for student experimentation. It should be anticipated that some students will be able to perform a limited number of open-end investigations. Considerable provision for projects and other individual interest experiences should be provided.

Chemistry 1-2

In this elective course a study is made of the composition of materials and the changes in composition which these materials undergo. Considerable emphasis is on student laboratory investigation and the reporting of findings. Teacher demonstrations are used to supplement the individual student experimentation. CHEM Study materials are used primarily.

Advanced Chemistry 1-2

This course provides a greater challenge than is provided in the regular course, Chemistry 1-2. Emphasis is placed on greater knowledge and wider maturity in analysis of data and techniques. Able and interested students should be encouraged to work on open-end type projects.

Physics 1-2

This elective laboratory course includes a study of the role of physics, measurements and mathematics, physcial properties, forces and motion, energy, heat, sound, light, electricity, electronics, and nuclear physics. Considerable student experimentation and evaluation with the use of laboratory equipment is involved. Student and teacher demonstrations are used to supplement the individual student experiments. The use of PSSC laboratory materials and techniques is encouraged.

Honors Physics 1-2

This course provides the student with a greater challenge than is provided in the regular course in physics. Emphasis is placed on mastery of selected areas rather than on expansion into additional areas of study. In achieving a more comprehensive mastery, the student (1) uses more rigorous mathematical derivations, (2) solves problems requiring a high degree of understanding of the application of fundamental principles, and (3) does laboratory experiments involving individual initiative and individual study of certain topics not normally covered in the regular physics course. Students should be expected to perform a limited number of open-end investigations. The use of PSSC Advanced Topics is encouraged.

Physiology 1-2

This course is designed to provide understandings of the functions of living organisms. Units studied are cells, tissues, main body systems, disease, and the effects of alcohol and narcotics. There should be considerable student involvement in individual and small-group laboratory investigations. These may be supplemented by student and teacher demonstrations.

Science Problems 1-2

This course is directed toward the layman's needs and interests. Since this will be the only senior high school science course for non-college preparatory students, a conscious effort is made to eliminate unnecessary technical terminology. The laboratory phase of this course will generally emphasize teacher demonstrations and student demonstrations. Individual and group laboratory activities are encouraged when appropriate. Generally these will require considerable structuring.

SPECIAL SCIENCE COURSES

Frequently other science courses are offered such as the summer enrichment science courses. Student participation in planning and conducting scientific investigations in usually one of the dominant aspects of these courses. Student background in investigative techniques may vary from one course to another, but individual classes usually contain students of similar science interest and background.

SCIENCE PROJECTS

A complete science program should employ such techniques as are necessary to ensure that each student may acquire scientific knowledge, skills, and attitudes to the extent of his ability. An opportunity for a student to demonstrate that he has acquired such knowledge, skills and attitudes and simultaneously improve them may be provided by individual or small group projects. Science students, especially the more able and creative ones, should be urged to plan and conduct investigations which may be the object of a class report and/or a project in the school science fair.

Such investigation, although it will usually be an extra-class or extra-school activity, should receive adequate guidance by the teacher so that it will be done safely and be of greatest possible benefit to the student. Assistance will be helpful to most students and especially to the inexperienced is:

1. Assistance in preliminary investigation. In most cases the place to start is in the library gathering more information about the specific areas of interest. Most students are familiar with the encyclopedias, but many are not familiar with the various science reference books and do not know how to use the Reader's Guide to Periodical Literature.

2. Assistance in delimiting the problem. Students often attempt to investigate a problem that is so broad that the experimentation is too complicated or the results are of little consequence.

3. Assistance in setting up valid experimental procedures. Be sure a sufficient amount of valid data can be acquired and that controls are used.

4. Assistance in meeting deadlines. Encourage an early start, with target dates set for various phases of the project.

FIRST AID

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Poisons 23
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Burns and Effects of Excessive Heat 27
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FIRST AID

Under normal circumstances the school nurse, upon notification of an illness or injury, will direct the activities necessary for an optimum conclusion to the incident. Her duties are such, however, that she will not always be available for first aid on the school grounds, since she must also make home calls, transport students, and engage in other health education duties.

It is the responsibility of each teacher to know how to proceed in the event a student becomes ill or is injured in his classroom or laboratory. The teacher's first responsibility is for the care of the injured or ill student in accordance with the established procedure of the San Diego City Schools. The teacher has in addition to his responsibility to the ill or injured student, a responsibility to his class. It is important that the teacher attempt to reduce the confusion and anxiety resulting from the illness or injury. Every effort should be made to return the class to its regular activity as soon as possible.

In the event of illness or injury to a student, it is expected that the teacher will act in an informed and objective manner with a minimum of emotional involvement. It is expected that the teacher will be able to (a) identify shock and be able to treat it, (b) proceed in an approved manner to control severe bleeding, and (c) administer artificial respiration; then take measures to reduce any anxiety or fear that the injured student or other students may experience. Once assistance is given, it should be continued until the victim is released to the proper person.

Do's and Don'ts in First Aid

Do--

Be calm and deliberate; there are only a few "life and death" cases.

Call for help.

Handle the person as little as possible.

Check with the victim and witnesses on the circumstances concerning the accident.

Make a prompt, complete, and accurate report of the accident.

Be cautious rather than casual.

Don't--

Give liquid to an unconscious person.

Try to arouse an unconscious person.

Let the person see his own injury, it it can possibly be avoided.

Don't--(Cont.)

Give medication.

Incise the skin--except in case of snakebite.

Diagnose.

Transport in your private car.

Send a student home before consulting parents.

Treat injuries that happened at home. We are concerned with injuries on the way to and from school.

Reduce dislocations.

Give medical advice.

EMERGENCY PROCEDURES

Copies of the poster "Emergency Procedures," (Stock No. 22-E-5101, See next page) should be posted permanently in each classroom, school office, custodial room, nurse's office and other appropriate places, and filed in the principal's office. This poster contains instructions to follow in case of various emergencies including health emergencies. It should be read carefully by the teacher and posted in a prominent place in the classroom.

The San Diego City Schools Health Services Department, in cooperation with the American Red Cross has developed the San Diego City Schools publication HE 505, "First Aid--How to Proceed in Case of Injury to Pupil," which may be found in this guide on pages 18 to 21. Due to the hazards inherent to science classes, more detailed first aid procedures follow on pages 22 to 27.

SAN DIEGO CITY SCHOOLS
Operation of Schools

EMERGENCY PROCEDURES

(Administrative Regulations and Procedures: 2330, 2750, 2755, 7415)

FIRE DRILL
(Proc. 2755)

School signal: repeated, short, intermittent bell signals . . . .
Action: Evacuate building according to school plan.
Room route:..
Drill: One per month or more.

EARTHQUAKE
(Proc. 2755)

Follow "Duck and Cover" procedures.
Evacuate building with fire drill procedures after quake has subsided.
Drill: Twice yearly.

CIVIL DEFENSE DISASTER
(Proc. 2750)

Red Alert (less than one-hour warning)

Signal: Siren rising and falling—3 minutes
School signal: School bell sounded for 1 minute without interruption
Action: Follow "Duck and Cover" procedures.
Drill: Twice yearly.

Yellow Alert (more than one-hour warning)

Signal: Siren steady tone—5 minutes
School signal: ....
(To be completed by school)
Action: Pupils and teachers report to classrooms and await instructions as to dismissal procedure:
....

TUNE TO RADIO FREQUENCIES 540, 600, 1170, or 1240

HEALTH EMERGENCIES
(Proc. 2330)

Serious Injury or Illness

1. Do not move patient until extent of injury is determined.
2. Call nurse if she is in building and render first aid. Notify the principal. The teacher, principal, elementary secretary or other qualified person may give first aid.
3. Notify parent or guardian immediately and arrange for transportation and care. If parent or guardian cannot be reached and child needs immediate attention, notify the POLICE, 232-6981, who will provide an ambulance if needed. Have competent person accompany the child if the parent is not present.
4. Fill out "Report on Accident, Non-Employee." This can be obtained from the school secretary.
5. Filed "Exemption Statements" do not apply in serious injuries or illnesses.

Minor Injury or Illness

1. Teachers should give first aid to pupils with minor injuries (if classrooms are supplied with first aid kits).
2. In case of first aid to minor injuries, it is not necessary to notify parents or fill out "Report on Accident, Non-employee" form.
3. In cases where an "Exemption Statement" has been filed, first aid in minor injuries should not be given. The home should be notified.

POISONING
(Proc. 2330)

Call 298-4681, ext. 244, or County Hospital, 291-3330. Then proceed as with "Serious Injury or Illness."

COPIES TO BE POSTED PERMANENTLY IN EACH CLASSROOM, SCHOOL OFFICE, CUSTODIAL ROOM, NURSE'S OFFICE, AND OTHER APPROPRIATE PLACES, AND FILED IN PRINCIPAL'S OFFICE.

SAN DIEGO CITY SCHOOLS

FIRST AID - HOW TO PROCEED IN CASE OF INJURY TO PUPIL

See: District Procedure 2330 - "Illness, Injuries and Health Emergencies"

Form 22-E-5101 - "Emergency Procedures"

SERIOUS INJURY:

1. Do not move patient until extent of injury is determined.
2. Call nurse if she is in building and render first aid. Notify the principal. The teacher, principal, elementary secretary or other qualified person may give first aid in the absence of the nurse.
3. Notify parent or guardian immediately and arrange for transportation and care. Have competent person accompany the pupil if parent is not present. If parent or guardian cannot be reached and pupil needs immediate attention, notify the POLICE - 232-6981 who will provide ambulance service if needed.
4. Fill out "Report on Accident" form. This can be obtained from the school secretary. (Stock Catalog No. 22-R-2150)
5. Filed "Exemption Statements" do not apply in serious injuries.

MINOR INJURY:

1. Teachers should give first aid to pupils with minor injuries if classrooms are supplied with first aid kits, including first aid instructions.
2. In cases of first aid to minor injuries, it is not necessary to notify parents or to fill out "Report On Accident" form.
3. In cases where an "Exemption Statement" has been filed, first aid in minor injuries should not be given. The home should be notified.

- -

Directions for First Aid
(To be used by school personnel)

These instructions apply to all personnel. Copies shall be placed in all first aid boxes and posted in first aid areas.

1. Abrasions and Cuts:

   a. Superficial: If dirt is present, wash gently with hexachlorophene product such as Phisohex and water. Wipe from center outward and dispose of cottom swab after each wipe. Do not use cotton or adhesive as dressing directly over wound. Apply antiseptic with an applicator. Apply gauze dressing. Petrolatum may be used on dressing.

   b. Deep, Irregular Wounds: Cleanse around wound. Apply clean dry dressing and refer for medical attention.

   c. Puncture Wounds: Cleanse and cover with dressing. Parents should be advised that medical attention may be required for tetanus prophylaxis. Make accident report.

FIRST AID (Continued)

2. Animal Bites: Cleanse wound thoroughly with hexachlorophene product such as Phisohex and water. Apply antiseptic and dressing. Notify parent for referral to family physician for treatment. Obtain information on animal for police or pound, or Department of Public Health. City Pound: 297-3708.

   Insect Bites and Bee Stings: Remove stinger, if present, by scraping away. Apply aromatic spirits of ammonia or a paste of baking soda to area. Cold compresses help to relieve pain. Refer black widow spider bites to parents for medical attention.

   Snake Bites: Have victim lie down. If bite is on an extremity apply constricting triangular bandage between bite and heart. Apply suction from Snake Bite Kit equipment. Apply ice pack to site of bite. If on a field trip, see directions in Snake Bite Kit. Follow serious injury routine.

3. Bleeding: From nose - place pupil in sitting position with head slightly FORWARD. Keep patient quiet. Avoid nose blowing. Apply pressure to both nostrils for as long as necessary (about 10 minutes).
   From wound - if necessary to stop flow, apply pressure in this sequence:
   a. With dressing and bandage to wound.
   b. To pressure points.
   c. By constricting triangular bandage to arm or leg but only if severe, life-threatening, uncontrollable hemorrhage is apparent. Treat shock which may accompany hemorrhage. Follow serious injury routine.

4. Blisters: If blister is open, apply dressing. Do not open blisters.

5. Burns: Simple burns - soak in ice water 15-30 minutes and apply dry sterile dressing.
   Extensive burns - treat for shock and secure medical aid immediately. Remove clothing from part (open no blisters). Place on clean sheet and cover with dressing or clean sheet. Use no petrolatum. Follow serious injury routine.

6. Drowning or Stopped Breathing: Apply mouth to mouth or other acceptable methods of artificial respiration. Treat for shock. Secure medical care immediately. Only qualified personnel may use other methods.

7. Ear: Earache - refer to nurse or principal or send home and refer to physician. Foreign bodies in ear - refer to parent. Advise examination by a physician.

8. Seizures: Keep lying down and turn on side until seizure is over to prevent self injury. Provide period of rest. Refer to parent.

9. Eye: Chemical burns - irrigate eye with water. Follow serious injury routine. Foreign bodies - pull down lower lid and look for object. Then pull upper lid forward and down over the lower lid - a foreign body can be dislodged and swept away with tears. If not removed, follow serious injury routine.

FIRST AID (Continued)

10. Fainting: Faint - place patient flat with head lower than feet. Have patient rest and refer as indicated.
Feeling of faintness - have patient stoop over with head between knees. Provide good ventilation in room and have patient rest.

11. Fractures: Treat for shock. Fractures may be suspected when any evidence of deformity or impaired motion is present, or when a fall or blow is accompanied by shock. Do not move patient until extent of injury is determined and first aid given. Apply splint and keep part immobile. If leg, use stretcher; if arm, apply sling; if collar bone, put arm in sling and keep immobile by binding to chest; if rib or skull, keep patient quiet. Follow serious injury routine.

12. Nose: Foreign bodies in nose - notify parent for referral to physician.
Nose bleed - see No. 3.

13. Poisons: In the event of poisoning at school:

See Poisons, p. 23

    a. Identify poison.
    b. Secure medical advice immediately.
    c. Follow serious injury routine.

Information may be obtained from County Hospital (291-3330) Emergency Room, or Health Services Department (298-4681, Ext. 244), Dr. Wetherill. For suspected food poisoning, save food samples and notify Health Department.

14. Shock: Place victim horizontal and keep him quiet. Continue rest until parent is notified. Cover victim to prevent loss of body heat. Avoid extreme warmth. Emergency medical care may be indicated.

15. Skin Conditions: Infection - cover lesion and notify nurse.
Rashes: send to office.

16. Splinters: Remove, if readily accessible. Apply antiseptic. If deeply imbedded, refer to parent, and advise referral to a physician.

17. Sprains: Consider as fractures until proved otherwise. Elevate the part, apply cold compresses. Notify parent.

18. Swallowed foreign bodies: Notify parent for referral to a physician.

19. Toothache: Oil of cloves on a small cotton pack may be used for temporary symptomatic relief after cavity has been cleansed and dried. Referral should be made to parent for dental care.

School employees may not diagnose, prescribe, treat or offer medication.

First-Aid Kits

Education Code 11953 states that every first aid kit shall contain as a minimum the following:

12 - 3" x 2" sterile gauze packages
4 - 1" gauze roller bandages
4 - 2" gauze roller bandages
4 - triangular bandages
1 - 1" roll adhesive tape

An American Red Cross First Aid Textbook or written instructions for use of the contents of the first aid kits.

Education Code 11953 - Whenever a field trip is conducted into an area which is commonly known to be infested by poisonous snakes, the first aid kit shall include a snake-bite kit. In San Diego Schools this is interpreted to mean snake-bite suction equipment.

1. A first aid kit may be purchased for each school (standard equipment) to be used for field trips.
2. Room kits consisting of a plastic first aid box are placed in selected classrooms for use by teachers in rendering first aid for minor injuries. Minimum supplies may be 2 oz. antiseptic, applicators and one dozen bandage compresses.

School nurses supply these first aid kits and keep them replenished.

Procedure approved
American Red Cross

Rev. 2-3-66 as

ARTIFICIAL RESPIRATION

The teacher should be familiar with the mouth-to-mouth method of artificial respiration and be able to demonstrate its use. This is the preferred method and should be used unless it is determined to be inappropriate due to the position or condition of the victim, since other methods are more likely to further aggravate chest or shoulder injuries that may be present. Several methods of artificial respiration are presented here, but there are these three essential points regardless of the method used:

1. Immediately establish an exchange of air.

2. Continue this exchange at a uniform rate.

3. Prevent shock.

Mouth-to-Mouth Respiration (Preferred Method)

In some cases this may be the only way to bring about an exchange of air. It is very efficient and can be given easily to adults as well as children. The first aider breathes into the mouth or nose of the victim with moderate pressure. He then removes his mouth and allows the victim to expire passively. The cycle is repeated slightly faster than the normal breathing rate. One hand is used to hold the nose, the other to hold the jaw forward to prevent obstruction of the air passage.

Back Pressure - Arm Lift

Applied to victim lying face down, head on hands, face to one side. Kneel near head facing feet of victim. Compression phase: Place your hands on back and roll forward. Expansion phase: Rock backward drawing victim's arms upward.

Arm Lift - Chest Pressure (Silvester method)

Applied to victim lying on his back. Special caution is needed to prevent obstruction of air passage when victim is in this position.

Compression phase: Fold arms on chest and apply pressure.

Expansion phase: Extend arms overhead to touch. This can be applied on the floor, table, or bed. If on bed a pillow should be placed under the mid-back.

Chest Pressure and Prone Pressure (old standard method - Shafer)

These consist of pressure on the rib cage in front or back. Inspiration is passive and depends on elastic recoil of rib cage. They are helpful but the exchange of air is about one half that of the back-pressure - arm-lift method practiced.

Back Pressure - Hip Lift and Back Pressure - Hip Roll

These two methods are effective but too difficult for most first aiders. They consist of pressure on the back, then lifting the hips.

POISONS

Aside from science classrooms, few dangerous poisons are used in the schools. Proper storage and safety precautions have been effective in preventing poisoning. This prevention program should be maintained. The danger of poisoning is present and teachers must be ready to act immediately.

Poisoning may result in school from the following:

Insect and rodent poisons.
Cleaning agents which contain lye, ammonia and kerosene or other fuels.
Overdose of drugs from sources outside the school.
Food poisoning.
Laboratory chemicals.

Food poisoning is not likely under the standards of cleanliness and storage procedures maintained in the cafeteria; however, it can happen. When food is prepared by students, care should be taken to insure cleanliness and proper storage. The City Health Department has published strict regulations governing food served by caterers or parents in the cafeteria.

A person is often not aware of food poisoning until the poison has left the stomach. In such a case medical care must be obtained. In the meantime, rest and quiet are the only active first aid measures the teacher should give. Save food samples and notify the Health Department.

The accidental consumption of chemical poisons in the classroom though rare, is a distinct possibility. It is advisable to maintain a policy of not tasting nor placing any substance in the mouth except as vital to the learning situation and under closely controlled conditions. Careful direction should be given in the use of pipettes. Suction devices, not the mouth should be used when pipetting poisons. Label all chemicals. If the labels are lost, dispose of the chemicals.

First aid in case of poisoning:

1. Identify poison.
2. Secure medical advice immediately.
3. Follow serious injury routine.

Information on poison antidotes may be obtained from:

1. County Hospital, 291-3330, Emergency Room
2. Health Services Department, 298-4681, Ext. 244.
3. Poison Information Center
   Children's Hospital of Los Angeles
   Telephone: Area Code 213, 664-2121

Additional first aid emergency procedures concerning solid and liquid poisons selected from the "Safety Education Data Sheet No. 21 rev.," published in Safety Education, volume 44, no. 1, September, 1964 are found on the following page. This magazine is a publication of the National Safety Council.

Excerpt from Safety Education*

"31. The following are the recommendations of the Committee on Toxicology of the American Medical Association.

"The aim of first-aid measures is to help prevent absorption of the poison. Speed is essential. First aid measures must be started at once. If possible, one person should begin treatment while another calls a physician. When this is not possible, the nature of the poison will determine whether to call a physician first or to begin first-aid measures and then notify a physician. Save the poison container and material itself, if any remains. If the poison is not known, save a sample of the vomitus.

"WHAT TO DO BEFORE PHYSICIAN ARRIVES

"32. SWALLOWED POISONS

"In all cases, except those indicated below, remove poison from patient's stomach immediately by inducing vomiting. This cannot be over-emphasized, for it is the essence of the treatment and is often a lifesaving procedure. Prevent chilling by wrapping patient in blankets if necessary. Do not give patient alcohol in any form.

"A. Do not induce vomiting if:

1. Patient is in coma or unconscious.
2. Patient is in convulsions.
3. Patient has swallowed petroleum products (i.e., kerosene, gasoline lighter fluid).
4. Patient has swallowed a corrosive poison (symptoms: severe pain, burning sensation in mouth and throat, vomiting).
    - (a) Acid and acid-like corrosives: sodium acid sulfate (toilet bowl cleaners), acetic acid (glacial), sulfuric acid, nitric acid, oxalic acid, hydro-fluoric acid (rust removers), iodine, silver nitrate (styptic pencil).
    - (b) Alkali corrosives: sodium hydroxidelye (drain cleaners), sodium carbonate (washing soda), ammonia water, sodium hypochlorite (household bleach).
5. Call physician immediately.

"If the patient can swallow after ingesting a corrosive poison, the following substances (and amounts) may be given to dilute poison, not to induce vomiting.

For acids: milk, or milk of magnesia (1 tablespoon to 1 cup of water).

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*National Safety Council, "Safety Education Data Sheet No. 21 rev.," Safety Education, volume 44, no. 1, September, 1964.

For alkalis: milk, water, or any fruit juice, or vinegar.
For patient 1-5 years old - 1 to 2 cups.
For patient 5 years and older - up to 1 quart.

"B. Induce Vomiting When Non-Corrosive Substances Have Been Swallowed:

1. Give milk or water (for patient 1-5 years old - 1 to 2 cups; for patient over 5 years - up to 1 quart).
2. Induce vomiting by placing the blunt end of a spoon or your finger at the back of the patient's throat, or by use of this emetic: 2 tablespoons of salt in a glass of warm water.

When retching and vomiting begin, place patient face down with head lower than hips. This prevents vomitus from entering the lungs and causing further damage.

"33. OTHER TYPES OF POISONING

"The physician should be contacted for treatment of other types of poisonings.

"A. Inhaled poisons

1. Carry patient (do not let him walk) to fresh air immediately.
2. Open all doors and windows.
3. Loosen all tight clothing.
4. Apply artificial respiration if breathing has stopped or is irregular.
5. Prevent chilling (wrap patient in blankets).
6. Keep patient as quiet as possible.
7. If patient is convulsing, keep him in bed in a semi-dark room; avoid jarring or noise.
8. Do not give alcohol in any form."

SNAKE, INSECT, ANIMAL, AND HUMAN BITES

Rattlesnakes are the only poisonous snakes in San Diego County. They are common in the canyons and mountains. While everyone bitten by a rattler does not die, immediate action is necessary. Seldom do insect bites result in death but the pain and suffering may be avoided by fast action. Dogs often come onto the school grounds and bite students. Human bites are not unheard of in the schools. Treatment for the latter is similar to that for dog bites. Following is the proper action to take in each of the cases mentioned, keeping in mind that the general directions given for all first aid cases must also be followed.

Snake bite

1. Have victim lie down.
2. If bite is on an extremity, apply constricting, triangular bandage between bite and heart.
3. Apply suction from snake bite kit equipment.
4. Apply ice pack to site of bite.
5. If on a field trip, see directions in snake bite kit.
6. Follow serious injury routine.

Insect bites

1. Remove stinger, if present, by scraping away.
2. Apply aromatic spirits of ammonia or paste of baking soda to area.
3. Apply cold compresses to help relieve the pain.
4. Refer black widow spider bites to parents for medical attention.

Animal bites

There is danger of infection and rabies from bites of all warm-blooded animals. Students should be advised to leave dogs and all other strange animals alone. Animals often become confused in the unfamiliar surroundings of the school, and bite a student. Animal bites should be handled as follows:

1. Cleanse wound thoroughly with hexachlorophene product such as Phisohex and water.
2. Apply antiseptic and dressing.
3. Notify parent for referral to family physician for treatment.
4. Obtain information on animal for police or pound or Department of Public Health. City Pound--phone number 297-3708.

Human Bites

Wash and apply antiseptic and dressing, as with animal bites mentioned above.

BURNS AND EFFECTS OF EXCESSIVE HEAT

Injuries resulting from burns can cause severe pain and infection. Shock and even death can result from serious burns. Knowledge of the proper care of burns is essential for a first aider as a part of regular school duties or in preparation for major disaster. Experience has shown that in major disasters, such as explosion, over one-half of the injuries involve burns.

Continued training on fire prevention and fire drill procedure must be carried on in each school.

Burns may be caused in school by flames, steam, hot liquids, chemicals, and electricity.

The degree or extent of burns will in part determine the treatment used.

First degree means a minor burn. The skin is reddened. Soak in ice water 15-30 minutes and apply dry, sterile dressing.

Second degree means blisters are formed.

Third degree means deeper tissue destruction. The skin is often charred with first and second degree burns also present.

For second and third degree burns, lotions and ointments should not be used. Applying a sterile dressing, treating for shock and getting medical aid are usually the proper first aid at school. Occasionally it may be advisable to use compresses soaked in a solution of baking soda (three tablespoons per quart of water) or epsom salts (same proportion). A first aider should not remove clothing that sticks to the skin or open blisters.

Chemical burns need washing with large amounts of water. As in the case of poisons, some containers of chemicals may suggest other helpful first aid measures applicable for that chemical. Use "Neutralize" solution or saturated sodium bicarbonate solution. Keep the affected area clean and obtain medical aid.

In all cases of burns our job is to:

Relieve pain

Prevent infection

Prevent serious shock

POISON OAK

Wash well with soap and water, then alcohol. If rash develops refer to parents for treatment. We have poison oak in San Diego County, but no poison ivy.

FIRST AID KITS FOR FIELD TRIPS

The most helpful information for a first aider is that which he knows automatically. Knowledge of how to find vital information in a first aid textbook may be very worthwhile in some cases. A first aider will often have to improvise the materials he will use because we cannot know when and where accidents will occur. Some first-aid supplies should be convenient to the places where injuries are the most likely to occur.

Recent surveys in San Diego show these to be the areas where reported accidents occurred in order of their frequency: play area, gym, classrooms, shops, halls, stairs, to and from school.

A first aid kit is required whenever a group takes a trip away from school. This kit should be checked out from the nurse's office. It should contain:

Small finger dressings, Zephirin, applicators.

Sterile gauze pads - remove from package without handling surface to be placed over wound.

Roller bandages - can be used to hold a gauze pad in place. Unwind only a few inches at a time, hold close to the surface, twist to take up slack.

Tape - cut off several strips before putting on the dressing.

Buckle tourniquet - padded to avoid injuring the victim.

Inhalants - approved only for use in case of fainting.

Cotton tips - supplied or can be made with sterile cotton.

Burn ointment - for minor burns only.

If iodine is in the kit it should be replaced with Zephirin.

Other supplies that might be added to this kit are green soap and baking soda.

Everyone using materials from this kit should replace them or inform the nurse so new supplies can be ordered.

FIRST AID IN-SERVICE TRAINING

Procedures for First Aid In-Service Training have been established so that school employees will be prepared to act adequately and immediately in dealing with injuries occurring at school. The SAN DIEGO UNIFIED SCHOOL DISTRICT ADMINISTRATIVE REGULATIONS AND PROCEDURES, No. 4420, SUBJECT: FIRST AID IN-SERVICE TRAINING is quoted as follows:

"A. PURPOSE AND SCOPE:

1. To outline the administrative regulations and procedures for mandatory in-service training in first aid in schools K-12.

"B. GENERAL:

1. The program shall be conducted annually after the opening of school.

2. Employees Required to Attend. Principals, teachers, elementary secretaries and others who have daily contact with students, as designated by the principal.

   a. All employees named above, except those holding a valid Red Cross First Aid Certificate issued within the past three years, shall be required to take one lesson per year, completing four lessons every four years. (See B. 3. c. below.)

3. The Course

   a. Length: Four 1½-hour lessons.

   b. Schedule: At the convenience of the site administrator.

   Revised 3-9-64

   c. Content: Lesson plans are outlined in the "Guide to First Aid Inservice Training," 1962, Stock No. 31-G-8823.

4. Teachers of First Aid. School nurses and others selected for teaching the course are not required to hold First Aid Certificates.

5. First Aid Certificates and salary credit will not be provided for those completing the course, due to its brevity (6 hours).

. . . .

"D. PROCEDURE:

1. Principal

   a. Plans the in-service training program with the school nurse or other selected person.

   b. Establishes procedure for attendance recording and make-up in the individual school or at district-wide make-up course at Alice Birney School in the spring which will be publicized in the Superintendent's Bulletin."

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FIRES

It is the responsibility of each science teacher to be prepared to act deliberately and intelligently in the event of a classroom fire. It is important that the teacher and his students know not only the location of the fire fighting aids--the blanket, the extinguishers and the fire alarm box--but also how to use them.

It is good laboratory practice that no teacher demonstration or student experiment involving possible danger of fire be performed without being preceded by a discussion of the danger. This refers to the use of any open flame or the use or production of combustible material. It is strongly recommended that the teacher stage periodic fire drills in each class and actually select students to get the required fire-fighting aids and be prepared to discuss their use and limitations. In the event of a fire, students should be able to react in an orderly and rapid manner. Careful attention by the teacher to the problem and techniques of fire prevention and control may well prevent a serious injury.

Fires Involving Personnel

Each chemistry and physics laboratory is equipped with a fire blanket in a container attached to the wall. It is most important that students and teachers know its location and that it be accessible to both.

The principal value of the fire blanket is in extinguishing personnel fires. If a student's hair or clothing be ignited, it is sometimes difficult to secure enough water quickly to be of aid. The blanket will effectively smother the fire. A constant danger in personnel fires is that the affected student will seek his own aid and in a state of panic run about fanning the flames, thus magnifying the danger to himself. If clothing is on fire the student should be made to lie down and be rolled up in the blanket. If the student's hair is on fire the blanket should be applied to the head, being careful not to smother the student, until sufficient water is available to complete extinguishing the fire.

The carbon dioxide fog extinguisher should not be used for personnel fires. The carbon dioxide fog is extremely cold and may freeze the body tissues.

In any fire involving injury to students, the school nurse should be sent for and asked to administer first aid, if necessary.

Fires Involving Material or Equipment

The most common causes of laboratory fires are failure to understand the nature of the supplies or equipment being used; carelessness in handling the supplies or equipment; horseplay; and permitting combustible debris, paper towels, etc., to accumulate.

The principal concern in any material fire is that students immediately move away from the fire area. The teacher must quickly determine the immediate and potential danger from the fire. If there is any cause to believe the fire might spread or represent a danger to the classroom or students, the fire alarm must be sounded. It is the responsibility of the teacher to know the location of the fire alarm boxes near his classroom. The first responsibility of the teacher is the protection of his students.

If the fire is small and the potential danger of its spreading negligible, the teacher may use either the carbon dioxide fog or the foam extinguisher.

Fog Extinguisher

The carbon dioxide fog extinguisher is light in weight, portable, and capable of being turned off when the fire is extinguished. The nozzle permits the fog to be directed on the burning substance. This extinguisher is most effective on small fires. It effectively lowers the temperature of the burning material and smothers the fire. The fog extinguisher is generally found either in the science classroom or is shared in the supply room connecting two classrooms. Under no circumstance is the fog to be directed at a student. To ensure the service ability of these extinguishers at all times, they should be inspected periodically. The extinguisher should not be used for such purposes as CO_2 production for experimental purposes.

Foam Extinguisher

The foam type fire extinguishers generally are found outside the classrooms, mounted on or in the wall. In order to remove the extinguisher, the glass door must be broken. Care must always be exercised that the glass be broken with an object, never with the hands or feet or any other part of the body. This type of fire extinguisher, when inverted, causes a fire-smothering foam to be ejected from the hose. The extinguisher cannot be shut off. It ceases to function only when all the foam has been ejected. The foam extinguisher is most effective on large fires and on fires where the wind might reduce the effectiveness of the carbon dioxide fog.

Safety Regulations

Each teacher should formulate his own safety rules that best fit the classroom and subject taught. The following however, should receive careful consideration:

1. Special discussion or safety precaution should always precede the use of any combustibel liquid such as alcohol, benzene, gasoline, ether, etc. NO violation of the safety provision should be permitted.

2. All persons performing science activities involving hazards to the eyes must wear approved eye protection devices. All persons in dangerous proximity must be likewise equipped. See the section of this quide regarding Eye Safety on page 36.

3. Students should be warned never to use quantities of combustible materials in excess of the stated requirements for the experiment.

4. When students are using Bunsen burners, they should be informed of the danger to clothing and hair. Girls with long hair, shoulder length or longer, should provide a cover or put their hair up to lessen the danger of fire. Students with loose-fitting clothing should wear aprons. Loose or baggy sleeves should always be rolled up.

5. Students should be instructed never to light a Bunsen burner with a flaming paper or paper towel. The burner should always be lighted with a match or striker.

6. Additional precautions with open flame burners:

   (a) Avoid operation in draft of open window or open door.
   (b) Protect connecting hoses of gas burners from being pinched or pulled from gas outlets.
   (c) Use substantial stand to support propane burners to prevent upsetting.
   (d) Protect counter tops from extreme heat by using asbestos insulation under burner or heated object. Wooden blocks (nonstock BLO-3040) may also be used to protect counter tops and vary the vertical position of the burner.

7. Warm or burning material should not be deposited in trash receptacles. Containers for this purpose should be available.

8. The teacher should know the location of the gas shut-off master valve for his room and use this valve in case of a gas leak in the room. The teacher should be constantly vigilant for escaping gas.

EYE SAFETY

The science curriculum involves many activities that present danger from flying particles or objects, from splattering hot or corrosive substances, or from damaging radiation. Since the eyes are especially vulnerable to injury from such hazards, teachers must take measures to provide eye protection during these activities. If certain experiments are especially dangerous and adequate protection is not available, these experiments should be eliminated from the program.

Eye safety devices are recommended for the science program on the following basis:

Device	Recommended Allowance
1. Spectacles, clear plastic with side sheilds Willson VS-4	1 Class set (40)/ each high school laboratory and each 2 General Science rooms
2. Goggles, plastic, splashproof AO #484B	1/each teaching station, prep room and project room
3. Face Shield, quick adjustable AO #H3W64	1/each teaching station, prep room and project room
4. Case, portable for 36 spectacles	Same as, No. 1
5. Shield, safety SH-24200	1/Prep Room
6. Shield, safety SH-24000	1/Prep Room

These various devices may be expected to provide eye protection for personnel in the following manner:

Spectacles - Protection against impact and moderate splash.

Goggles - Protection against impact and splash - reduction of dust and fumes.

Face shield - Partial protection of face against impact and splash.

Safety shield - Group or personal protection from splash and impact.

These devices should not be considered 100 per cent effective against all potential eye hazards. Appropriate combinations of devices may be used for optimum protection.

Eye Safety Suggestions for Science Teachers. In order that they may establish an effective eye safety program, teacher should--

1. Orient the students to the need for and use of eye protective devices.

2. Consider eye safety when planning each science activity. Refer to page 38 of this section of the guide titled "Pupil Safety, Eye Protection."

3. Establish routine procedures for the distribution of the individual eye-protective devices when needed and for their subsequent return to the storage case.

4. Make certain that all persons in the proximity of a hazardous situation, as well as the experimenter (s), use the eye protective devices.

5. Maintain reasonable standards for cleanliness, since eye protective devices will usually be shared by several persons. Students with unhealthy, possibly contagious, skin or eye conditions should be encouraged to purchase personal safety glasses; or a pair should be reserved for their exclusive use.

6. Establish a definite, readily accessible location in the designated areas for each type of eye protective device.

7. Make certain that demonstrations involving explosive or potentially explosive substances are so arranged as to shield both pupils and teachers from any danger. The safety shield should be used to protect students and the face shield and/or goggles to protect the teacher. Size of apparatus and quantities of reagents used in a demonstration should be conisistent with safety, i.e., preparation of H_2, Cl_2, Br_2, I_2, H_2S, P_4O_{10}, CO, etc.

8. Ensure that, due to the greater probability and severity of eye hazards, splashproof plastic goggles are provided for use in project rooms. Students should have ready access to the goggles and be instructed to use them.

PUPIL SAFETY, EYE PROTECTION

The following information pertinent to eye protection in science classrooms is quoted from the San Diego Unified School District Administrative Regulations and Procedures, Supplement No. 2780-1, Subject: Pupil Safety, Eye Protection.

"B, 2. Assembly Bill No. 95 (1965 Legislature) requires that eye protective devices by worn by students, teachers, and visitors in classrooms including, but not limited to, vocational or industrial arts shops or laboratories and chemistry and physics laboratories, at all times when that individual is engaged in, observing, or in proximity to an activity likely to cause injury to the eyes. In compliance with this bill, approved eye-protective devices must be worn by students when participating in the activities listed below or when observing in the immediate area of the activities.

. . . .

"B, 2, c. Science

"(1) General Regulations--Eye-protective devices must be provided for participants and observers in the following situations:

"(a) Impact Hazards

--Pneumatic pressure or evacuation operations, including the pressure cooker.
--Operation of power tools.
--Operation of centrifugal (centripetal) devices.
--Projectile and collision demonstrations.
--Handling of elastic materials under stress; e.g., springs, wires, rubber, glass, etc.
--Working with or igniting explosive or implosive devices or substances.
--Working with hot, molten metals
--Hammering, chipping, grinding rocks, minerals and metals.
--Cutting or breaking glass.

"(b) Hazardous Substances

--Pouring, pumping or dispensing corrosive substances.
--Heating or electrolysis of chemicals.
--Generation of toxic or potentially explosive gases.
--Mixing chemicals which react violently.
--Preserving and staining of biological specimens.
--Cleaning and sterilizing with corrosive substances including ammonia, detergents and solvents.

"(c) Hazardous Radiation

--Direct viewing of the sun.

NOTE: No approved eye protection is provided. Avoid this activity.

--Use of infra-red and ultra-violet light sources.

NOTE: No approved eye protection is provided. These sources must be shielded from direct view.

"(2) Science Demonstration Activities--Science demonstrations involving hazards to the eyes must be conducted as follows:

"(a) Use of safety shields to protect observers, with approved eye-protective devices to be worn by the teacher or student operators,

or

"(b) Use of approved eye-safety devices for all operators and observers.

"d. Student Science Laboratory Activities--All persons performing science activities involving hazards to the eyes must wear approved eye-protective devices. All persons in dangerous proximity to such activities must be likewise equipped. For example, in chemistry laboratory experiments involving hazardous substances or procedures, all persons must be protected.

"e. Storeroom, Preparation Room, or Project Room Activities--Because of the greater probability and severity of many eye hazards in storerooms, preparations rooms, and project rooms, all persons performing or observing hazardous activities in these areas must be equipped with the approved eye-safety devices specified for these areas.

SUPERVISION OF PROJECT ROOMS

The project room is provided in order to improve the instructional program of the school. The activities which take place in the classroom as well as the project room are the responsibility of the classroom teacher, and it is imperative that every effort be made to reduce the possibility of injury to any student. The following general points are given for the use of project rooms.

1. Project room should not be used as chemical reagent storage room.
2. Adequate working area should be provided.
3. If venetian blinds are provided, they should be kept open. If not, the door should be left ajar.
4. Only students who have demonstrated a capability for working in the regular laboratory should be allowed to work in the project room.
5. Before the student begins work in the project room, he should present an outline of his proposed project to the teacher for approval.
6. The teacher should see that all materials and equipment needed for the project room are made available to the student.
7. Normally no more than two students should occupy a project room at any one time.
8. The teacher should make periodic checks of progress.
9. No student should be permitted free access to the project room in the absence of the teacher. This should also pertain to the laboratory.
10. The teacher is responsible for every act of the students in his classroom and under his supervision.
11. Due to the greater probability and severity of eye hazards, splash-proof plastic goggles are provided for use in project rooms. Students should have ready access to the goggles and be instructed to use them.

SAFETY PRACTICES WITH RADIATION EQUIPMENT AND MATERIALS

The details of this section were intended for situations in which individuals or groups actively participate in investigations or projects involving the use of radioactive materials. It does not refer to class demonstrations of the use of the radiation detector or cloud chamber.

The properties of radioactive materials are such that they have numerous applications in scientific research, in medicine, and in industry. It is anticipated that these applications will not only continue, but increase dramatically in number and in kind. The science program of the San Diego City Schools must provide students with an opportunity to investigate radiological theory and uses of radioactive materials and to develop techniques and skills in handling such materials safely.

The use of radioactive isotopes in California is regulated by the U. S. Atomic Energy Commission and by laws and regulations of the State of California. Teachers or other prospective users of radioactive isotopes should obtain the State of California publication "Laws and Regulations Relating to Atomic Energy Development and Radiation Protection" by requesting it from:

State Department of Public Health
Bureau of Radiological Health
966 Subway Terminal Building
417 South Hill Street
Los Angeles, California 90013

It is expected that the teacher will confine his use of radioactive materials to quantities of such low hazard potential as may be obtained, stored, and used without the need for obtaining a specific license. Permission to obtain, store, and use small quantities of radioactive materials is automatically granted and is referred to as a "general license." The quantities of radioactive materials available in the nonstock catalog conform to the restrictions of the general license. Examples of maximum quantities that may be obtained under the general license are: Carbon-14, 50 uc; (uc = microcuries) Phosphorus-32, 10 uc; Iodine-131, 10 uc. Under a general license a user may possess at one time up to ten such quantities of material. For example, he may possess at one time 500 uc of Carbon-14 in ten separate sources, or 450 uc of Carbon-14 (in nine units) and 10 uc of Iodine-131. He may possess fractional scheduled quantities of as many isotopes as needed to the extent that the total of all quantities does not exceed 10 scheduled quantities. The degree of decay of each sample may be considered when totaling the quantities in possession. The maximum unit quantities of most radioactive isotopes are found in Schedule B, Section 30236, Title 17, California Administrative Code (See p. 5.) Although these quantities of material may be purchased without need for a specific license, the user is not exempt from adhering to the regulations pertaining to their use.

The nature of radioactivity is such that even though very small potential hazard quantities are used, carefully planned and executed safety precautions must be accomplished. Each teacher who receives radioactive materials must assume responsibility for supervising their use and/or safe storage, observing the following safety practices:

1. Records. The importance of keeping complete, permanent records of all events associated with radioactive materials cannot be overemphasized. Such record keeping will serve as exemplary procedures for instructing students as well as provide significant permanent information. A bound notebook may serve as a logbook in which is recorded the following kinds of information:

    a. Kinds and amounts of radioactive materials possessed, the date of receipt, the use made of them, the name of the user, and the method and date of their disposal.

    b. Class rosters - when students actively particpate in investigations relating to ionizing radiation. These records should clearly indicate the presence or absence of the student on a given day, and if present, the amount of exposure to radiation.

    c. Details of unusual incidents which may occur, such as a spill.

    c. Monitoring records.

2. Monitoring. The laboratory equipment should be monitored to ascertain the absence of contamination. This should be done before and after each experiment and at regular intervals in addition. Records of the laboratory monitoring should be maintained in the logbook. Clothing and hands of the personnel should be included in the monitoring. Dosimeters or film badges should be used to establish the extent of exposure of personnel, and the data obtained entered in the logbook.

3. Signs. On days when radioactive isotopes will be used, a large poster or sign containing the radiation symbol should occupy a prominent position where each student will see it upon entering the classroom. The symbol should be covered or removed when students will not be exposed to radiation. This will aid in keeping students alert to potential danger. All of the students in the school should be informed of the significance of the radiation symbol. Visitors must not be allowed in the laboratory except by special arrangement.

4. Labeling. All radioactive materials should be clearly labeled. Adhesive-backed labels with the proper legend and color are available commercially. Glassware and equipment which retain a relatively high activity should be labeled and segregated from general use. All apparatus, once it has been used with radioactive materials, is often retained for that exclusive use. Clearly label the cages/containers of all experimental animals/plants.

5. Controls. All radioactive materials should be kept under lock and key when the responsible individual is not in the laboratory. Students should never be allowed to remain unsupervised in the laboratory with radioactive materials, not even radioactive waste solutions.

6. Protective Equipment. Preventing contamination is easier than decontaminating furniture and equipment. Avoid spills by clamping containers or keeping them in secondary containers such as a beaker or a hole drilled in a block of wood which is not easily upset. Confine spills by working in trays lined with absorbent material having water-repellent backing. Disposable diapers, diaper paper, or similar set-up may protect the working surface from contamination. Always use a forceps or tongs to handle radioactive materials--never pipette by mouth. If inhalation of vapor or powders is possible, use the fume hood or gloved box.

7. Protective Clothing. Skin and personal clothing may be protected from contamination by wearing rubber gloves or plastic disposable gloves and laboratory aprons or coats. Ingestion of radioactive materials is the greatest danger involved in handling generally licensed materials.

8. Personal Safeguards. Never eat, drink, smoke, chew gum or use cosmetics in a room where radioactive materials are being used. Washing hands with soft brush, soap and water must be standard procedure following the handling of radioactive material even though gloves are worn.

9. Maintain Good Housekeeping. Remove unnecessary equipment from a working area where it might become contaminated. Give immediate attention to cleaning up any contamination.

10. New Procedures. Try out all new procedures with "dry runs" not involving the use of radioactive material.

11. Disposal of Radioactive Waste. Collect and label all radioactive waste. Personal responsibility for disposal should be assumed by the teacher. Soluble materials obtained under a general license can usually be discharged into the sanitary sewer if diluted with large quantities of water. Similar quantities of solid materials (including animal carcasses, organs and plants) should be incinerated.

Decontamination Procedures. The problem of decontaminating a particular surface will vary with the amount and kind of contamination. The following procedures should be sufficient for any spill that occurs. When several steps are listed, monitor after the first step and if the contamination is not removed, continue or repeat the decontamination process. The maximum radiation level of a decontaminated area is generally considered to be double background when monitored with a thin-windowed G.M. probe less than an inch from the surface and there is no removable contamination as indicated by a wipe test.

1. Skin-spot Contamination. Use a soft brush with soap and water. Repeat if necessary, but do not continue to the extent of damaging the skin.
2. Clothing. Wash with detergent and hot water.
3. Rubber. Wash first with suds and hot water, then rinse in dilute nitric acid; follow with scouring powder and rinse.
4. Glassware. Wash with detergent and hot water, then with a chromic acid cleaning solution if necessary.

5. *Metal.* Wash with detergent and hot water. If necessary, wash in dilute HNO_3 or 10 per cent sodium citrate solution.
6. *Linoleum.* Wash with detergent and hot water. Wash with CCl_4, kerosene or ammonium citrate solution if required.
7. *Ceramic Tile.* Wash with detergent and hot water, then with mineral acid, trisoduim phosphate or ammonium citrate.
8. *Painted Surfaces.* Wash with detergent and hot water. Wash with CCl_4 or 10 per cent HCl if contamination remains.
9. *Concrete.* Wash with detergent and hot water. Wash with 32 per cent HCl if necessary.
10. *Wood.* Wash with detergent and hot water. Plane surface if contaminant is a long-lived isotope.
11. *Laboratory Taps and Drains.* Flush with large volume of water. Scour with scouring powder or rust remover.

Laws and Regulations Relating to Atomic Energy Development and Radiation Protection

The following excerpts form Title 17 of the California Administrative Code which may also be found in the State of California publication "Laws and Regulations Relating to Atomic Energy Development and Radiation Protection" include pertinent information for the teacher. These excerpts do not obviate the necessity of obtaining and utilizing that publication.

"Article 4. Licenses

"30190. *Types of Licenses.* Licenses for radioactive materials are of two types: General and specific, except that licenses for special nuclear material in quantities not sufficient to form a critical mass are limited to specific licenses.

General licenses provided in this regulation are effective without the filing of an application with the department or the issuance of licensing documents to particular persons.

Specific licenses are issued to named persons upon application filed pursuant to this regulation.

. . . .

"30192. *General Licenses--Other Radioactive Materials.* (a) A general license is hereby issued:

. . . .

"(2) To receive, possess, use or transfer up to the quantities of radioactive materials listed in Section *30326*, Schedule *B*, provided that no person shall at any one time *possess or use*, pursuant to the general licensing provision of this paragraph, more than a total of *10* such scheduled quantities."

. . . .

"Article 6. Records, Reports and Inspections

"30215. Records. Each person who receives radioactive material pursuant to a license under this regulation shall keep records showing the receipt, transfer, and disposal of such radioactive material.

……

"Article. 10. Schedules."

TITLE 17
(Register 62, No. 1—1-20-62)

RADIATION

30236. Schedule B.

Radioactive material	Column No. I Not as a sealed source (microcuries)	Column No. II As a sealed source (microcuries)
Antimony (Sb^{124})	1	10
Arsenic 76 (As^{76})	10	10
Arsenic 77 (As^{77})	10	10
Barium-lanthanum 140 (BaLa^{140})	1	10
Beryllium (Be^{7})	50	50
Cadmium-silver 109 (CdAg^{109})	10	10
Calcium 45 (Ca^{45})	10	10
Carbon 14 (C^{14})	50	50
Cerium-praseodymium 144 (CePr^{144})	1	10
Cesium-barium 137 (CsBa^{137})	1	10
Chlorine 36 (Cl^{36})	1	10
Chromium 51 (Cr^{51})	50	50
Cobalt 60 (Co^{60})	1	10
Copper 64 (Cu^{64})	50	50
Europium 154 (Eu^{154})	1	10
Fluorine 18 (F^{18})	50	50
Gallium 72 (Ga^{72})	10	10
Germanium 71 (Ge^{71})	50	50
Gold 198 (Au^{198})	10	10
Gold 199 (Au^{199})	10	10
Hydrogen 3 (tritium) (H^{3})	250	250
Indium 114 (In^{114})	1	10
Iodine 131 (I^{131})	10	10
Iridium 192 (Ir^{192})	10	10
Iron 55 (Fe^{55})	50	50
Iron 59 (Fe^{59})	1	10
Lanthanum 140 (La^{140})	10	10
Manganese 52 (Mn^{52})	1	10
Manganese 56 (Mn^{56})	50	50
Molybdenum 99 (Mo^{99})	10	10
Nickel 59 (Ni^{59})	1	10
Nickel 63 (Ni^{63})	1	10
Niobium 95 (Nb^{95})	10	10
Palladium 109 (Pd^{109})	10	10
Palladium-rhodium 103 (PdRh^{103})	50	50
Phosphorus 32 (P^{32})	10	10
Polonium 210 (Po^{210})	0.1	1
Potassium 42 (K^{42})	10	10
Praseodymium 143 (Pr^{143})	10	10
Promethium 147 (Pm^{147})	10	10
Radium 226 (Ra^{226})	0.1	1
Rhenium 186 (Re^{186})	10	10
Rhodium 105 (Rh^{105})	10	10
Rubidium 86 (Rb^{86})	10	10
Ruthenium-rhodium 106 (RuRh^{106})	1	10
Samarium 153 (Sm^{153})	10	10
Scandium 46 (Sc^{46})	1	10
Silver 105 (Ag^{105})	1	10
Silver 111 (Ag^{111})	10	10
Sodium 22 (Na^{22})	10	10
Sodium 24 (Na^{24})	10	10
Strontium 89 (Sr^{89})	1	10
Strontium-yttrium 90 (SrY^{90})	0.1	1
Sulfur 35 (S^{35})	50	50
Tantalum 182 (Ta^{182})	10	10
Technetium 96 (Tc^{96})	1	10
Technetium 99 (Tc^{99})	1	10
Tellurium 127 (Te^{127})	10	10
Tellurium 129 (Te^{129})	1	10
Thallium 204 (Tl^{204})	50	50
Tin 113 (Sn^{113})	10	10
Tungsten 185 (W^{185})	10	10
Vanadium 48 (V^{48})	1	10
Yttrium 90 (Y^{90})	1	10
Yttrium 91 (Y^{91})	1	10
Zinc 65 (Zn^{65})	10	10
Beta and/or gamma-emitting radioactive material not listed above	1	10

. . . .

"Article 3. Permissible Doses, Levels and Concentrations.

"30267. Exposure of Minors. (a) No user shall possess, use or transfer sources of radiation in such a manner as to cause any individual within a controlled area who is under 18 years of age, to receive in any period of one calendar quarter from all sources of radiation in such user's possession a dose in excess of 10 per cent of the limits specified in the table in Section 30265 (a).

(b) No user shall possess, use or transfer radioactive materials in such manner as to cause any individual within a controlled area who is under 18 years of age to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Section 30355, Appendix A, Table II. For purposes of Section 30267 (b) concentrations may be average over periods not greater than a week.

(c) The provisions of Section 30266 (b) shall apply to exposure subject to Section 30267 (b).

Note: Provision has been made for exposure of minors, primarily to permit them to use radiation for training and educational purposes.

. . . .

"30269. Concentration in Effluents to Uncontrolled Areas. (a) Except as authorized by the Department pursuant to Section 30286 or Section 30269 (b), no user shall possess, use, or transfer any radioactive material in such a manner as to release into air or water in any uncontrolled area any concentration of radioactive material in excess of the limits specified in Section 30355, Appendix A, Table II. For purposes of Section 30269 (a), concentrations may be averaged over periods not greater than one year.

. . . .

"Article 4. Precautionary Procedures.

"30281. Storage of Sources of Radiation. Sources of radiation shall be secured against unauthorized removal from the place of storage.

. . . .

"Article 5. Waste Disposal.

"30287. Disposal by Release into Sanitary Sewerage Systems. No user shall discharge radioactive material into a sanitary sewerage system unless:

(a) It is readily soluble or dispersible in water..."

. . . .

ROCKET AND MISSILE SAFETY PRECAUTIONS

The following statements are reprinted from San Diego Unified School District Administrative Regulations and Procedures No. 2780 (Revised 3-21-66).

B. 4. a. Rockets and Missiles - Current interest in rocketry requires that the district restate its position constantly. Principals must make the following regulations knows to all teachers:

(1) Safety as well as instruction is the district's aim, and the principles of rocket propulsion are to be taught without the use of dangerous materials.

(2) Construction or experimentation with missiles is prohibited. Also, pupils should be cautioned of the dangers involved in such activities at home. The use of chemicals or liquid or solid fuels is prohibited. It is permissible to conduct simple experiments through the use of rubber balloons, coiled springs, etc.

Teachers:

(a) May instruct the students in the general principles of rockets and missiles.

(b) May conduct simple experiments demonstrating the principles of rocketry through the use of rubber balloons, coiled springs, etc.

(c) May caution the students about the dangers of experimentation with rockets and missiles at home as well as at school.

(d) Must refrain from:

(1) Providing chemicals for rockets or missiles or helping students to obtain them.

(2) Using or permitting to be used liquid or solid fuels in the classroom, as such use constitutes essentially a controlled explosion.

(3) Permitting construction of rockets, missiles or component parts in the classroom or shop.

SAFETY IN GENERAL SCIENCE AND SCIENCE PROBLEMS CLASSROOMS

Since all areas of life and physical science are included in these courses, teachers of General Science and Science Problems must be familiar with the safety precautions in all parts of this guide. It is recommended that the teacher carefully review the section of this guide pertinent to each unit as he plans his laboratory activities.

Every science teacher should be aware of the requirements of Assembly Bill No. 95 (1965 California Legislature) concerning the use of eye protective devices in classrooms. He should also be familiar with the section of this guide pertaining to eye protection. (See pages 38 to 39 of this guide). All of the hazardous activities listed on those pages are pertinent to teachers of General Science and Science Problems, but perhaps unique to these teachers would be the following:

1. Hammering, chipping, grinding rocks, minerals and metals

   Investigations in geology and earth science frequently involve such activities. The use of eye protective devices as well as a cloth covering over the rock or mineral to reduce the hazards from flying particles is indicated.

2. Direct viewing of the sun

   Note: No approved eye protection is provided. Avoid this activity.

   Images of the sun may be projected, or use the Questar with filter. The viewfinder of the Questar should not be used during an activity involved with viewing the sun. Avoid eye injury which may result from accidentally tripping the mechanism and engaging the viewfinder. This may be accomplished by placing tape on the bracket supporting the mirror for the finder in such a manner as to shade the mirror. Teachers must closely supervise all such activities using the Questar.

3. Use of infra-red and ultra-violet light sources

   Note: No approved eye protection is provided. These sources must be shielded from direct view.

   Special attention is also directed to page 50, "Safety in Specific Life Science Activities."

SAFETY IN BIOLOGY AND PHYSIOLOGY CLASSROOMS

1. Teachers must be fully acquainted with the first aid procedures, treatment, and regulations.

2. Teachers must report any injury or accident immediately on forms available, "Report of Accident."

3. All persons performing science activities involving hazards to the eyes *must* wear approved eye-protective devices. All persons in dangerous proximity to such activities must be likewise equipped. (See the section of this guide pertaining to Eye Safety, pages 36 to 37.)

4. Teachers should notify the principal of the existence or development of any hazard that comes to their attention.

5. In a demonstration experiment, using any flammable volatile liquid such as alcohol, care must be taken that any flame in the room is a safe distance from the volatile liquid.

6. In experiments requiring special biologicals such as nicotine alkaloid, care should be taken that such materials are carefully supervised.

7. The use of drugs and hypodermic needles must be limited to those specifically called for by the instructional program and for specific projects under close supervision of the instructor. Keep all such drugs and hypodermic equipment in a safe and preferably locked place.

8. Radioactive materials used in biological research should be properly marked and secured.

9. Keep all reagent bottles and storage bottles labeled at all times.

10. Unknown liquids should be discarded by carefully pouring them down the sink, accompanied by large quantities of water.

11. Unknown solids should be disposed of in the stone crocks provided in each biology laboratory. They should not be disposed of in the waste basket.

12. Always be aware of or have available to you, the proper first aid action to be taken in the event of accident in the biology classroom.

Safety in Specific Life Science Activities

A. Blood experiments

1. If blood typing or other analysis of human blood is to be conducted in the classroom, it must be on a voluntary basis.

2. The danger of spreading infectious diseases such as hepatitis makes it necessary that only sterile techniques be employed.

3. Care must be exercised that only sterile needles or lancets be used. Dipping the needle or lancet in alcohol is not sterilization.

4. If there are several students who wish to volunteer to have their blood analyzed, it is necessary that each have a sterile lancet or needle.

5. The surface of the finger from which the blood is withdrawn must be rubbed with alcohol before and after removing blood.

6. The use of disposable lancets (nonstock LAN-0510 or LAN-0511) is recommended for this activity. Each lancet should be used only for one person and then carefully and deliberately discarded.

7. A satisfactory needle for pricking the finger can be made by pushing a Bard-Parker surgical blade through a cork so that about 1/16 of an inch of the point extends beyond the flat surface of the cork.

8. If needles or lancets are used they must be placed in an autoclave or pressure cooker for twenty minutes at not less than fifteen pounds of gauge pressure to insure sterilization.

9. The spring-type lancet may be used, if sterile, to prick the finger for blood withdrawal. The lancets would be used only for teacher demonstrations

B. Epithelial tissue study

Great care should be exercised by students in obtaining epithelial cells from the inside of the cheek for study under the microscope. Only wood splints or the blunt edge of a toothpick should be used. Pointed instruments or any part of a scalpel should never be used for this purpose.

C. Osmosis experiments

1. In the osmosis experiment, care should be exercised in inserting the thistle tube through the rubber stopper.

2. Do not grasp the thistle tube by the bowl; grasp the tubing of the thistle tube near the rubber stopper.

3. Use a lubricant such as water, glycerine, or liquid detergent.

4. Use a towel to protect the hands.

D. Bacterial experiments

1. Pathogenic bacteria should not be cultured.
2. Petri dishes passed around the classroom for inspection of cultures should be bound together with scotch tape.
3. Wire loops used for transferring bacteria cultures should be flamed after each transfer is made.

E. Operation of pressure cooker for sterilization

1. Before operating the pressure cooker, the teacher should be familiar with the proper directions for its operation.
2. Examine safety value to make sure it is in working order.
3. Do not allow the gauge pressure to go over twenty pounds.
4. Be sure the pressure has returned to zero before attempting to remove the cover.
5. Use eye protection device when working with cooker under pressure.

F. Extraction of chlorophyll

1. Only pyrex or other hard glass test tubes should be used.
2. Use an electric heater of the immersion type or a water bath heated by an electric hot plate.
3. Do not use an open-flame-heated water bath for heating the alcohol.
4. Keep the flames away from alcohol or alcohol vapors. If alcohol ignites in the beaker, cover the beaker with a glass plate to extinguish the fire. If burning alcohol is spilled on the table, use either the carbon dioxide fog extinguisher or the fire blanket. (These materials should be readily available.)

G. Use of dissecting instruments

Students should be instructed in the safe use of dissection instruments. Special care should be taken to avoid cuts or scratches when cleaning scalpels and needles.

H. Use of formalin

1. Specimens preserved in formalin should be thoroughly washed before being handled by the students. When removing specimens from formalin solution, rubber gloves should be worn--or use forceps or tongs, depending on the size of the specimen. Use eye protection devices to protect against splash and fumes.

2. Formalin fumes are irritating to the eyes and throat. Adequate ventilation should be provided in any room where formalin is used.

Laws Regulating Care and Use of Animals

The regulations governing the use of animals in the classroom for educational purposes are stated in the Health and Safety Code of the State of California. The regulations primarily state that animals used for educational experimental purposes must be kept in satisfactory shelter, be humanely treated, be supplied with adequate food and water and be kept in a sanitary condition.

San Diego City and County rodent control ordinances do not apply to the keeping of animals for experimental or educational purposes in schools.

The sections from the State Health and Safety Code that apply are as follows:

Health and Safety Code

Section 1650

The public health and welfare depend on the humane use of animals for scientific advancement in the diagnosis and treatment of human and animal diseases, for education, for research in the advancement of veterinary, dental, medical and biologic sciences, for research in animal and human nutrition, and improvement and standardization of laboratory procedures for biologic products, pharmaceuticals and drugs.

Section 1651

The State Department of Public Health shall administer the provisions of this chapter.

Every provision of this chapter shall be liberally construed to protect the interests of all persons and animals affected.

As used in this chapter, "person" includes: laboratory, firm, association, corporation, copartnership, and educational institution.

As used in this chapter "board" means the State Board of Public Health.

As used in this chapter, "department" means the Department of Public Health.

Section 1660

The department shall make and promulgate, and may thereafter modify, amend or rescind, reasonable rules and regulations to carry out the purposes of this chapter, including the control of the humane use of animals for the diagnosis and treatment of human and animal diseases, for research in the advancement of veterinary, dental, medical and biologic sciences, for research in animal and human nutrition, and for the testing and diagnosis, improvement and standardization of laboratory specimens, biologic products, pharmaceuticals and drugs. Such rules and regulations shall include requirements for satisfactory shelter, food, sanitation, record keeping, and for the humane treatment of animals by persons authorized by the board to raise, keep or use animals under the provision of this chapter. The department shall not make or promulgate any rule compelling the delivery of animals for the purpose of research, demonstration, diagnosis, or experimentation.

Section 1662

The department is hereby authorized to insepct any premises or property on which animals are kept for experimental or diagnostic purposes, for the purpose of investigation of compliance with the rules and regulations adopted hereunder. Such inspection or other method of control shall be enforced only by employees of the department and such power and authority may not be delegated to any other persons or agency.

Municipal Code, Section 44.0341

It shall be unlawful for any person within the corporate limits of the City of San Diego to construct, maintain, operate or permit to exist any building or other structure on premises wholly or partly in his possession or under his control, which is not rat-proof and free of rats in accordance with the provision of this article.

(Interpretation: Teachers must not give rodents for students to keep at their homes.)

Vivisection

Vivisection as used in this guide refers to the cutting or operating on a living animal for purposes of physiological or pathological study. Vivisection is not permitted in the science classroom.

Teachers should avoid any classroom project or procedure which might approach or appear to approach vivisection. Such practice would not be an approved curriculum activity. Any gain in learning that might result from a technique of this kind would be heavily outweighed by the objections of many students and parents.

Dissection

The fact that vivisection is to be avoided does not imply that dissections are not a significant and valuable educational experience for students of the life sciences. Generally the animals are either dissected by the teacher as a demonstration or individually by the students. These animals should be especially prepared for this purpose by a responsible biological supply house.

There will exist, however, times when fresh animal or animal parts are necessary to the lesson being studied. An example might be the demonstration of the contraction of the cardiac muscle independent of the central nervous system. In this and other similar situations, live material may be used. By live material it is meant animal tissue removed within a period of several hours. The animal should be sacrificed in such a way that there is a minimum of emotional involvement by the students. The teacher should sacrifice the animal out of the sight of the students and have the animal prepared or have the part removed for study before the students arrive for class.

Experiments requiring live animal tissue should generally be restricted to the tissue of cold-blooded vertebrates and invertebrates.

If cold-blooded vertebrates are pithed to prepare the live animal tissue, it is advisable to pith them prior to the class. Be sure that the student understands the procedure of pithing, however, and the fact that the animal, even though it appears to be alive, is for practical purposes a dead animal. This will avoid unnecessary complications about the use of live animals for experimental purposes in the classroom.

Experiments using live animal tissue should in general be restricted to the biology and physiology classes in the senior high schools, and be avoided in the junior high school or by the general science classes.

There will be occasionally in the life science classes students who are not emotionally prepared to participate in dissections. These students may feel faint or be made ill by the experience. The teacher is advised to try sympathetically to aid the student in overcoming his anxiety and concern. If this sympathetic approach fails, it is better that the student not be forced to do or participate in the dissection. It must be made clear to the student that his excuse from the dissection does not relieve him of the responsibility for knowing the information to be derived from the dissection.

Experiments Involving Use of Animals

Direct observation of animals at all levels of instruction in the biological sciences is a desirable educational experience. In order that the presence of animals in the classroom produce desirable educational goals, certain precautions should be observed.

Humane treatment of animals must always be observed.
Animals must be kept in a sanitary environment.
Animals must be kept with a supply of fresh food and water.
Cages should be placed in the classroom or project room so that odors will not disrupt the class.
Care must be provided for animals over holidays and weekends.
Students should not be permitted to take home any animals that are ill or may have a contagious disease.
Students should not be permitted to take home any rodent.

The common types of laboratory animals--white mice, rats, guineas pigs, etc.--should not be brought to school by students. If there is a need for them in the classroom, they should be purchased from companies supplying animals to the medical profession. This is a justifiable expenditure of instructional supply funds. Propagation of animals should be consistent with the instructional program.

Rodents, especially rats, are best disposed of through the Health Department Rodent Control Laboratory.

Unless there is a valid compelling reason, animals that are poisonous or vicious, such as rattlesnakes, black widow spiders, hamsters, and other animals which require much care to avoid student injury, should not be kept in the science classroom.

Parakeets and parrots are sometimes brought into the life science laboratory to demonstrate speech in animals as well as the conditioned response. These birds contribute much to the clarification of these physiological processes. However, parakeets and other psittacine birds are potential carriers of psittacosis virus. Only banded birds are to be brought into the classroom. The banded bird cannot be guaranteed to be free of psittacosis, but is less likely to be infected than those unbanded birds with unknown pedigrees.

The use of cockerels for investigating the effects of hormones must be carefully planned and executed. Students should be well prepared for all phases of the investigation so the inoculation will be accomplished without injury to the animals or undue emotion on the part of the students. All of the precautions mentioned in the first paragraph of this page must be carefully observed. The students must recognize the fact that the cockerels must be humanely sacrificed at the end of the experiment. This should be done by the teacher when the students are not present. The injected animals would never develop normally, and even the controls would never produce worthwhile meat, since the cockerels used are not of meat-producing varieties.

Insect-Killing Jars

Students, either for science projects or for study in the classroom, will need to be familiar with the best way to collect and preserve insects. From a safety viewpoint no instructor should encourage or make available insect-killing jars containing potassium cyanide. Admittedly, potassium cyanide is most effective in killing insects; but its danger in the hands of junior and senior high school students is so great as to deny its use in the classroom.

A safer type of killing jar can be made by using any clean, large, screw-type lid jar (mayonnaise jars are quite acceptable). A kleenex tissue is placed in the bottom to serve as an absorber of the killing liquid. Several liquids can be used to provide the lethal fumes; carbon tetrachloride or carbona is probably best, although ether, chloroform or ethyl alcohol can be used. The killing liquid is added to the kleenex tissue in the bottom of the jar; about six drops generally is satisfactory. On top of the kleenex tissue containing the liquid, a clean tissue is placed to keep the insects dry. The jar must be labeled DANGER, POISONOUS FUMES, DO NOT BREATHE.

It is a simple task to recharge the jar with lethal fumes by removing the top tissue and adding a few more drops of the killing liquid. A clean tissue is then replaced and the jar is again ready for use.

The students must be adequately instructed in the use and proper construction of this device.

SAFETY IN CHEMISTRY CLASSROOMS

1. Teachers must be fully acquainted with the first aid procedure, treatment, and regulations.

2. Teachers must report any injury or accident immediately on the available forms, "Report of Accident."

3. Teachers should notify the principal of the existence or development of any hazard that comes to their attention.

4. In a demonstration experiment, using any flammable volatile liquid such as alcohol, care must be taken that any flame in the room is a safe distance from the volatile liquid.

5. Demonstrations involving explosive or potentially explosive substances must be so arranged as to shield both pupils and teachers from any danger. Use the safety shield available in the classroom to protect students and face shields and/or goggles to protect the teacher. Size of apparatus and quantities of reagents used in a demonstration should be consistent with safety, i. e., preparation of H_2, Cl_2, Br_2, I_2, H_2S, P_4O_{10}, CO, etc.

6. Students should be evacuated from seats directly in front of the demonstration table even if the possibility is remote that injury to them might occur from spattering of chemicals, inhalation of fumes, etc.

7. All persons performing science activities involving hazards to the eyes must wear approved eye protection devices. All persons in dangerous proximity must be likewise equipped. (Read carefully the section of this guide pertaining to Eye Safety, pages 36 to 37.)

8. Large storage bottles of strong acids and bases should not be stored on narrow shelves; if possible, they should be stored on the floor or the lower shelf of a cabinet.

9. Never add water to concentrated sulfuric acid. To dilute sulfuric acid add the concentrated acid to water in small quantities, stirring constantly.

10. White phosphorus must be kept under water. This form must also be cut under water. If cut in the open air, the friction may be sufficient to ignite the material with dangerous results. Use red phosphorous in place of white phosphorus whenever possible.

11. Red phosphorus should be made available for student use only in small quantities. When red phosphorus burns it produces toxic phosphorus pentoxide. Red phosphorus fires are very difficult to put out. Red phosphorus resublimes as white phosphorus.

12. Residues of phosphorus should be completely burned in the hood before depositing in the waste jar.

13. Metallic sodium, potassium, calcium and calcium carbide must not be stored above water solutions or vessels containing water. Metallic sodium or potassium, after the original container has been opened, must thereafter be kept under kerosene. These substances are corrosive and must not come in contact with the skin.

14. Care must be taken to give proper instruction and caution regarding the use of polyethylene squeeze bottles and dropping bottles.

15. On inserting glass tubing into rubber stoppers or tubing, observe the following precautions:

    a. Never attempt to insert tubing having a jagged edge. Fire polish, if possible. Otherwise, bevel the edge with a file, wire gauze or emery cloth.

    b. Use water, soap solution, glycerine or vasline as a lubricant, and force the tube into the hole by a twisting motion.

    c. Always aim the tubing away from the palm of the hand which holds the stopper or rubber tubing.

    d. Always hold glass tubing as close as possible to the part where it is entering the rubber stopper.

    e. The use of a cloth wrapped around the hand or the tubing at the point of contact with the hand will help avoid injury if the glass breaks.

    f. When inserting a thistle tube into a rubber stopper, do not grasp the thistle tube by the bowl. Always wet the tube and use a twisting motion when applying pressure.

16. Keep all bottles labeled at all times.

17. Liquids or solids found in unlabeled bottles should be discarded. Do not guess as to the nature of the substance.

18. Unknown liquids should be discarded by carefully pouring them down the chemicals sink, accompanied by large quantities of water. Do not pour acids or unknown liguids into a porcelain lined sink.

19. Unknown solids should be disposed of in the stone crocks provided each chemistry laboratory. They should not be disposed of in the waste basket.

20. Bottles containing acids or organic volatile liquids should never be placed near heating pipes, nor allowed to stand in the sun. Dangerous gas pressures may be built up.

21. Never cap or stopper a bottle containing dry ice; always plug loosely with cotton.

22. Dry ice can be preserved for short periods of time by wrapping the ice in several layers of newspaper to insulate and reduce rate of sublimation. Dry ice should be handled with great care to avoid contact with skin and eyes.

23. Glass wool and steel wool should be handled carefully to avoid getting splinters in the skin and eyes.

24. Where obnoxious or poisonous fumes are produced, the stationary or portable fume hood should be used.

25. Protect table tops from extreme heat by using asbestos insulation under burners or heated objects.

26. Exercise care so that long hose connections between burners and gas outlets are protected from pinching or being pulled away from the outlet.

27. Small bottled-gas cylinders should be provided with safe stands to prevent upsetting which may result in personal injury and destruction of laboratory facilities.

28. Large gas cylinders must be kept in the cart provided for their transport. Valves should be kept in perfect working order. Careful instruction should be issued and close supervision given if students are to use this facility.

29. Do not use solid benzoyl peroxide. It is a dangerous chemical, particularly when jars or cans of solid become slightly moist. It should not be kept in a high school laboratory. Benzoyl peroxide is available in the form of pastes in which it is mixed with an ester oil, such as diethyl, or with butyl benzyl phthalate. These pastes are much safer than the pure compound and react effectively.

Safety Suggestions for Students of Chemistry

Students are to observe each of the following rules and safety measures.

1. Be familiar with the location of the fire extinguishers, fire blanket, and fire alarm box.

2. Do not handle apparatus or chemicals without previous specific instructions.

3. All persons performing science activities involving hazards to the eyes must wear approved eye-protective devices. All persons in dangerous proximity to such activities must be likewise equipped. For example, In chemistry laboratory experiments involving hazardous substances or procedures, all persons must be protected.

4. Report to the teacher at once any personal injury sustained--burn, scratch, cut, or corrosive liquid on skin or clothing--no matter how trivial it may appear.

5. Never pour reagents back into bottles, or exchange stoppers of bottles, or lay stoppers on the table.

6. When heating test tubes, do not look down into the tube while heating it or point it in the direction of any student during the process.

7. When collecting gas by water displacement, remove the delivery tube from the generating flask prior to removing the heat so that water will not be forced back into the hot generator.

8. Always provide a cloth or towel to cover any apparatus used to generate gases. Example: Hydrogen generator size should never exceed 250 ml.

9. When bending glass, allow time for glass to cool before further handling. Hot and cold glass have the same visual appearance.

10. Always test for odor of chemicals by wafting hand over container and sniffing cautiously.

11. Always put all solid waste in proper stone or porcelain receptacles.

12. Handle squeeze bottles, dropping bottles and medicine droppers with extreme care to prevent squirting or spilling.

13. Wear face shield or protective goggles when performing experiments or demonstrations which are hazardous because of spattering or potential explosion.

②

Safety in Specific Experiments in Chemistry

Laboratory Preparation of Oxygen

A. By Potassium Chlorate and Manganese Dioxide

1. In preparing oxygen by use of potassium chlorate and manganese dioxide, care must be taken to avoid contamination with any other oxidizing agents. If other oxidizing agents are to be used in the experiment, such as powdered metals, magnesium ribbon, organic substances, etc., they should not be placed on the same table with the potassium chlorate and manganese dioxide. Students should be warned of the danger from contamination. Use only chemically pure potassium chlorate and very clean equipment.

2. In the experiment where oxygen is prepared by heating manganese dioxide and potassium chlorate, make certain that the bottles of manganese dioxide and charcoal powder are not placed on the same shelf or near each other in the laboratory. By keeping them in different parts of the room, the possibility will be reduced that a student might mistake one for the other and thereby possibly cause an explosion.

3. Warn students against allowing the carbon from wood splints to fall into the hot potassium chlorate-manganese dioxide mixture. If this should occur, heating must be stopped immediately.

4. When large quantities of oxygen are needed, use the gas cylinders.

B. By Sodium Peroxide

If the sodium peroxide method is used for preparing oxygen, the following precautions should be used to promote safety:

Avoid contact of skin with moist sodium peroxide.

Make certain that no active sodium peroxide if left in contact with paper or other easily ignitable substance. If paper is used for pouring the chemical into the generator, soak it thoroughly with water before discarding.

It is suggested that an Ehrlenmeyer or Florence flask be used as a generator instead of a bottle, thus reducing the possibility of cracking the generator due to the heat of reaction.

It is suggested that the sodium peroxide be handed out to students in the dry flasks, all ready for use.

The water must be carefully controlled by a dropping funnel.

C. By Using Hydrogen Peroxide (supplemental method)

Oxygen may be safely prepared from a 3 to 5 per cent solution of hydrogen peroxide which is dropped on either powdered manganese dioxide or pelleted activated charcoal. No heat is necessary.

Laboratory Preparation of Hydrogen

A. Active Metals and Strong Acids (most acceptable)

1. Check apparatus for leaks before beginning reaction.

2. Never ignite hydrogen coming from a generator until you are quite certain that there is no residual air in the generator. One may test for this by taking samples of the evolving gas in a small test tube and bringing these to a Bunsen flame until a non-explosive sample (no "pop") is obtained.

3. It is advised that a towel always be wrapped around the hydrogen generator when the gas is being generated. The maximum size of generator should be 250 ml.

B. Active Metal and Water (not for student experimentation)

In putting potassium or sodium on water, use very small amounts to minimize dangerous spattering. It is suggested that a medium-sized evaporating dish be used for this experiment, and that a watch glass or glass plate be used to cover it immediately after the metal is put on the water. The reaction of sodium on water is safer and should be used in preference to potassium.

Electrolysis

Hydrogen in small quantities can be prepared in relatively pure form for demonstration purposes by use of the electrolysis apparatus.

Dehydration of Sugar

In the demonstration of the dehydration of sucrose by sulfuric acid, the spongy lump of carbon remaining often contains some concentrated acid. Pupils should not be permitted to handle the carbon or its container.

Laboratory Preparation of Rhombic Sulfur

1. By use of carbon disulfide

   a. Carbon disulfide is the best solvent for preparation of rhombic sulfur.

   b. Carbon disulfide should be used only when there is adequate ventilation and all Bunsen burners are turned off.

   c. After completing the experiment and before lighting the Bunsen burners to proceed to other experiments, the watch glasses containing the rhombic sulfur should be placed in the fume hood.

   d. Carbon disulfide should be dispensed to students under strict supervision.

2. By use of carbon tetrachloride

Carbon tetrachloride, as a solvent for sulfur, is a poor substitute, but is much safer than carbon disulfide. Avoid inhaling carbon tetrachloride fumes.

Laboratory Preparation of Sulfur Dioxide

1. Unless good ventilation is available, it is inadvisable to perform this experiment in the laboratory except as a demonstration.

2. The students should be cautioned against inhaling the gas.

Laboratory Preparation of Halogens

1. Students should be cautioned about the toxic nature of the halogen fumes.

2. In testing for the halide ions do not use carbon disulfide. Carbon tetrachloride works just as well and is non-flammable, but caution is needed to prevent inhaling the fumes.

3. It is suggested that chlorine, bromine, and iodine be prepared only by the instructor as a demonstration and only in small quantities.

4. Bromine vapor is poisonous and corrosive to the mucous membrane and the skin; it should be collected under water. Liquid bromine should be prepared only in small quantities. The bromine prepared from this experiment should not be saved. It may be diluted and stored as bromine water, however. If bromine water is kept, be sure the cap on the bottle does not permit the fumes to escape.

5. Hydrofluoric acid is dangerous both in liquid and gaseous form. Soluble fluorides are poisonous. Care should be used in disposing of residue of fluoride salts used in etching. Wastes should be thoroughly flushed down the drain.

Laboratory Preparation of Nitrogen and Nitrogen Compounds

A. Nitrogen

Preparation by heating sodium nitrate and ammonium chloride:

This method should not be used as a laboratory experiment.

The mixture of sodium nitrate and ammonium chloride is likely to explode if over-heated.

If performed as a demonstration, make certain that the solution does not boil. If it does, add water.

B. Nitric Acid

Concentrated nitric acid is highly corrosive. Students should be cautioned against spilling it on their skin or clothing.

If nitric acid is spilled on the skin or clothing, it should be thoroughly diluted with water, then a solution of sodium bicarbonate or "Neutralize" used to wash the contaminated area.

C. Nitrous Oxide

Students should not prepare nitrous oxide unless very close supervision can be provided.

D. Nitrogen Iodide

Nitrogen iodide preparation should never be attempted by students under any circumstances.

Thermite Experiment

In performing the thermite demonstration, caution should be exercised in approaching a mixture that has apparently failed to ignite. It is advisable to wait two or three minutes. The mixture may flare up suddenly. Protect the laboratory table top with sufficient insulation during this demonstration.

Laboratory Preparation of Phosphine (Prohibited)

The preparation of phosphine in the laboratory by either the students or teacher is prohibited.

Phosphine is not only dangerous to prepare but the gas is highly toxic.

Preparation of Esters

The organic acid and sulfuric acid mixture should be heated over a water bath rather than a direct flame. Strong heat may cause spattering of the sulfuric acid.

SAFETY IN PHYSICS CLASSROOMS

1. Teachers must be fully acquainted with the first aid procedures, treatment and regulations.

2. Teachers must report any injury or accident immediately on available forms, "Report of Accident."

3. All persons performing science activities involving hazards to the eyes must wear approved eye-protective devices. All persons in dangerous proximity to such activities must be likewise equipped. (See pages 38 to 39 of this guide. Subject: Pupil Safety, Eye Protection.)

4. Electric current used in the laboratory should be sent through a protective load-limiting resistance in order that no more than the desired amount of current will flow under any circumstances.

5. In pupil experiments involving use of the electric current, voltage should be limited to a maximum of 30 volts. This does not apply to electrical laboratories or shops where students have special training and background and suitable precautions are taken.

6. Where circuit breakers are not privided, electric lines to pupils' tables should be protected by enclosed fuses only.

7. In removing an electrical plug from its socket, pull the plug, not the electric cord.

8. When inserting an electrical plug, hold plug so that any flashbacks due to a possible short circuit will not burn the palm of the hand.

9. In wiring an electrical circuit, make the "live" plug-in, or turn-on switch connection, the last act in assembling and the first act in disassembling. This is applicable to all portable electrical apparatus.

10. When using an electric current, avoid bringing both hands in contact with "live" sections of the circuit. If possible, use but one hand at a time in all manipulations involving an electrical circuit.

11. Electrical extensions used in the classroom for projection machines, etc., should be inspected regularly for defects in insulation or connections. Cords with ground wire should be used wherever danger of shock exists.

12. If the current is constantly used near any metal object, the object should be permanently protected with an insulating cover to avoid possible contact. General care should be observed to see that live wires do not contact grounded metallic objects.

13. Exposed live electric switches on the front panels of laboratory and preparation room switchboards should be shielded by a wire cover or other protective device whenever pupils have access to such panels.

14. Multiple plugs shall not be used in electrical wall outlets. Semi-permanent electrical connections shall not be made to all outlets. Electrical apparatus consuming more than 1500 watts shall not be connected to wall outlets. Motor-driven apparatus shall not be connected to wall outlets unless such apparatus is essentially portable. Under no circumstances shall a motor requiring a starting current of more than 1500 watts be connected to a wall outlet.

15. During the charging of a student storage cell, students should be kept away from the fine spray which develops. It is harmful if inhaled or allowed to get on skin of pupils.

16. Care should be observed in teacher and pupil handling of a storage battery. It is a source of danger in spite of its low voltage because of the acid it contains and because of the very high current which may be drawn from it on a short circuit. Charging of storage batteries should be done only in a well-ventilated space.

17. All types of induction coils should be clearly marked for the low voltage and high voltage connections in order to avoid the possibility of shocks.

18. Instructors and pupils should at all times be shielded from X rays and from ultra-violet apparatus.

19. In the handling of electronic equipment by teachers and pupils, the following precautions should be observed:

    a. Make certain that the current is off before putting hands into the radio or any electronic equipment.

    b. Be sure that there is a "bleeder" (high resistance) across the output of a power supply; otherwise, a severe shock from the charged condenser may result.

    c. In handling the so-called transformerless type of radio, where the tubes are series connected and the set works directly from the line, caution must be observed to prevent any grounded metallic object from coming in contact with the metallic chassis.

    d. In experimenting with a standard transformer radio, pupils must be cautioned on the handling of "B" voltages. The high voltage secondary is in the order of 600 v. AC and the rectified "B" voltage about 300 v. DC. Severe burns and shock can result from contact.

    e. Exercise care in demonstrating, adjusting or using image tubes of television receivers or cathode ray oscilloscopes when these tubes are removed from their protective housing. Such tubes should be removed only when necessary to the experiment.

20. In evacuating a bulb during the density of air experiments, wrap it in a towel to avoid flying glass if the bulb should be crushed. Also, use round-bottom flasks for the process. They are stronger than the flat bottom variety.

21. In using a pressure cooker to demonstrate variation of boiling points with pressure, be sure to examine the safety valve before use, to make sure it is in working order. Also, do not allow the pressure to go above 20 pounds.

22. Caution should be observed in the use of all rotating apparatus such as the whirling table, Savart's Wheel, siren disk, centrifugal hoops, etc. Make certain that the safety nut is securely fastened at all times; the apparatus should revolve at moderate speeds only.

23. Care should be taken to prevent pupil injuries due to sharp edges on mirrors, prisms and glass plates. They should be inspected before they are handed to pupils, and sharp edges removed by grinding them with emery cloth or carborundum stone, or painting the edges with quick-drying enamel. Pupils should be instructed to report at once any sharp-edged apparatus.

24. a. The practice of removing thermometers, glass tubing, etc. from rubber stoppers as soon as possible after use will avoid the possibility of the glass "freezing" to the rubber.

    b. To remove thermometer, rod or glass tubing which has been "frozen" in a rubber stopper, the following method has proved safe and efficacious. Use a wet cork-borer, just large enough to slip over the tube, and slowly work the cork-borer through the stopper, thus boring the "frozen" tube out of the stopper.

    c. As an alternate method to (b) above, it is suggested that the rubber stopper surrounding a frozen thermometer be slit open with a razor-blade.

APPENDIX (Equipment Lists)

(Equipment List)

Stock Number	Quan.	Description
AQ-10100	2/room	Aquarium, 8-gal. stainless steel frame, 18" x 8½" x 12", AAA Aquarium.
AQ-10200	1/room	Aquarium, 15-gal. stainless steel frame, 24" x 12" x 12", AAA Aquarium.
AU-50000	1/school	Autoclave, pressure cooker, cast aluminum, approximately 16-qt. capacity, 20 psi pressure gauge, safety valve and petcock, Cenco 44125, Welch 5298.
BA-30000	1/room	Balance, double beam, trip scale, agate bearings, metric, maximum capacity 2000 grams, maximum sensitivity 0.1 gram, stainless steel pans, plastic cover, Braun 123-48, Aloe V7502.
BA-30102	2/school	Balance, triple beam, capacity 311 grams, sensitivity .01 grams, two 100 gram attachment weights for weighing over 111 grams, plastic cover, Ohaus Cent-O-Gram, Aloe V7450, Braun 12337, Harshaw H2860.
BA-32000	1/school	Ballistics Car, with cylindrical socket and 1" steel ball, Cenco 75346, Welch 742.
BA-52100	1/room	Barometer, aneroid, brass case, 5" dial, open center, English and metric scales, Welch 1239, Harshaw H3620.
BA-52220	1/school	Barometer, mercurial, demonstration type, wood base, vernier attachment, Stansi 2704.
BA-70400	1/school	Battery, eleminator kit, 6-12v, Heath kit model IP-12.
BEL-2010	1/school	Bell jar, diameter 6 in., height 10 in., open top, straight form, Cenco 14305-2, Braun 14145.
BEL-2016	1/school	Bell jar, knob top, tall form, ground flanged rim, outside diameter 8-3/4", outside height 15". Braun 14107.
BEL-1000	1/schoo	Bell jar, extra tall form, approx. 88 cm. long overall, Cenco 14330, Stansi 3090, Welch 1483.

Stock Number	Quan.	Description
CA-14050	1/room	Cage, metal, 9" x 9" x 15", removable tray removable wire floor, end door, Aloe V2000A, Harshaw H260.
CA-14100	3/school	Cage, small animal, 14" x 18" x 18," all metal, rustproof finish, Aloe V2210A, Cenco 44030.
CA-14200	1/room	Cage, small animal, activity, wire mesh, removable tray, revolving cylinder, approx. 16" x 10" x 9", Turtox 220A525.
CA-24000	1/school	Caliper, Micrometer, metric, 0-25 mm., ratchet stop, Cenco 72655, Welch 40.
CA-52100	1/prep.	Cart, stock, 30" x 16" x 32", metal, 5" wheels, 2 stationary 2 swivel, two 16 gauge shelves with approx. 3" sides with turned edges. Corner posts not less than 1¼ x 1¼ x 1/8 angle steel, welded construction, Colson 545-SR.
CL-11000	1/school	Cloud Chamber, Raymaster, diffusion type, with clearing field battery, Alpha and Beta sources. Atomic Lab. Inc. Raymaster, Cenco 71850.
CO-15592	1/school	Collection, Rock and Mineral, Washington School Collection, 20 minerals and 20 rocks, in case, Braun 490-18, Welch 7070.
EL-29000	1/school	Electromagnet, 3-in-1 demonstration, Atomic Lab., Inc., Cenco 71854.
FI-60000	1/school	Fire Syringe, brass cylinder, Cenco 77250.
FL-50000	1/school	Fluorescent minerals kit, ultraviolet lamp and ballast, with 10 samples in kit. Cenco 71393.
GE-42300	1/school	Generator, Magneto electric, hand crank, incandescent lamp, mounted on base, Cenco 79895, Stansi 4750, Welch 2488.
GE-42610	1/school	Generator, Van De Graaf, 115 volt 60 cycle motor, maximum voltage 200,000 volts, height 17", Edmunds S70,264.
GL-38220	1/school	Globe, slated, 16", cradle mounted, Denoyer Geppert G16SO.
GL-38289	1/school	Globe, World, 16", Pictoral Relief, wood cradle A.J.Nystrom 7-412.

Stock Number	Quan.	Description
HO-68000	1/school	Hot Plate: electric, one burner, enclosed with steel cover plate, multiple switch, white acid-resisting enamel and chrome, heavy duty cord and plug, 115 volt, AC, Universal 5002.
IL-41000	1/school	Illuminator, optical disc, position fully adjustable, 100-watt, 115 volt projection lamp. Cenco 85264.
IN-16000	1/school	Inclined plane, adjustable height; height, length and angle scales. Cenco 75840, Stansi 1525 Welch 809.
IN-18000	1/school	Incubator, electric, temperature range from room to 56 C, thermostatic controlled, size approx. 11" x 12" x 10½", plug and cord. Aloe V51006, Boekel 1095, Welch 8352A.
IN-21100	1/school	Induction coil, heavy duty, 4-10 volt primary, approx. 1" spark, external adjustable vibrator. Braun 36060-1, Cenco 79800, Welch 2392A.
LE-45400	1/school	Lenses, demonstration set of 6, 5 CM in diameter, in box, Cenco 85680.
MA-21000	1/school	Magdeburg Hemispheres, pressed steel, with threaded stopcock, approx. diameter 4½" Cenco 76731.
MA-61125	1/school	Map, Polar World, 50" x 38", stereographic projection, spring roller, steel board, dustproof cover, Mtg. #15, Nystrom PW98.
MA-61795	1/school	Map, United States, Mexico and U.S. Possessions, Pictorial Relief 44 x 76", spring roller, Mtg. #15, Nystrom PR1.
MA-60390	1/school	Map, California, 44" x 54" physical-political, spring roller, Mtg. #15, Nystrom PS105.
MA-62000	1/school	Map, world, summer rainfall, winter rainfall, 52" x 62", spring roller, Mtg. #15, Nystrom AR981.

Stock Number	Quan.	Description
MA-62050	1/school	Map, world, thermal regions, vegetation regions, 52" x 62", spring roller, Mtg. #15 Nystrom AR982.
MI-09650	1/school	Micro-projector, 100 watt, mechanical stage and extra lamp. Bioscope Master Model 60.
MI-09625	1/room	Microscope, binocular, 1x 2x objective, parfocal, revolving nosepiece, 15x wide-field eyepieces, sturdy stand with elevation adjustment, removable contrast stage plate /black-white/, Swift Model #91.
MI-09810	5/school	Microscope, monocular, student. Triple nosepiece, 4x, 10x, and 40x achromatic objectives, 10x eyepiece, fixed condenser, disc diaphragm, with attached light source, but without case. Bushnell Model 404A/522A Elgeet HS-3.
MI-09830	1/school	Microscope, monocular, large general purpose, triple nosepiece with 10x, 40x, and 100x oil immersion objectives; 10x wide field, 5x and 15x periplane eyepieces; calibrated mechanical stage; sub-stage condenser with iris diaphragm; equipped with attached light source; with case. Elgeet Model H. Swift Model SMA.
MI-05000	1/school	Micro-Explano-Mounts; Botany, 25 mounts in set, Wards EXS250
MI-05010	1/school	Micro-Explano-Mounts; Zoology, 25 slides, Wards EXS 500.
MO-14395	1/school	Model, anatomical, portable unit, case with sexless torso and head, eyeball, ear, skin, carrying case. Denoyer-Geppart Y200E.
MO-14421	1/school	Model, engine, gas, four stroke, ignition spark shown by glow plug, size 10 x 9 x 12 ins. Viking Importers.
MO-20550	1/school	Model, steam engine, reciprocating, electrically heated, Viking Importers.
MO-71500	1/school	Motor: Electric, St. Louis, two-pole armature between two bar magnets, dissectible. Cenco 79945, Welch 2450.
MO-72000	1/school	Motor generator, experimental, ring design, permanent magnet field, two-pole armature, with two special field coils, Welch 2460A.

Stock Number	Quan.	Description
OR-37000	1/school	Organ pipe, metal, sliding piston, cylindrical, approx. length 27" Welch #3272.
	1/school	Planetarium (write new specs)
PO-91000	1/prep	Power supply unit, portable, variable low voltage, AC and DC. Continuous current output at least 5 amps. AC voltage from 0 to 24 volts, DC from 0 to 10.5 volts. Rheostat control, circuit breaker or fuse. Welch 2606K.
PU-32000	1/school	Pulley, differential, chain-hoist, deomonstration model, capacity 20 kg. Cenco 75707, Stansi 1385, Welch 780
PU-34400	1/school	Pump, vacuum-pressure, 1/3 hp motor, 115 volt, 60 cycle, single stage, oil, rotary pump, pressed steel base, 10" pump plate with nipple. Welch Wegner 1410N, Cenco 90515-1.
RO-81000	1/school	Rotator, hand operated, worm drive, spindle axes rotatable through 360 degrees. Welch 909A.
RA-12001	1/prep	Rack, test tube , 90 pins,Neoprene coated wire, rustproof pan, 19" x 18" x 7" deep, Braun 60996, Cenco 19225, Stansi 9176.
SH-24200	1/school	Shield, safety, plastic, wrap-around, 15" diameter, 29" high, 1/4" thick. Cenco 16483.
TE-20250	1/room	Terrarium Top, sloping front, glass enclosed, 12¼" x 18-3/8" x 8-5/8", to fit on and adapt the standard 8-gal. AAA Aquarium.
TR-36200	1/school	Transformer, variable, 0-135 volts, single phase, 120 volts, 50/60 cycles, maximum amperage 7.5, 1.0 KVA, with cord, plug, receptable, fuse and switch, Powerstat Type 116, Staco 500 B, Cenco 80297A, Welch 2608D.

Stock Number	Quan.	Description
TU-56210	1/school	Tuning forks, sympathetic, 256 VPS, mounted on resonance box, with hammer and instructions. Welch 3246.
MU-34800	1/school	Multimeter, lecture table demonstration, circuits and components on front panel, size 9 x 7 x 10½ inches high. Welch 3065.
WE-34000	1/room	Weights, lab, brass, metric, 13 weights in wooden block, 1 to 1000 grams. Cenco 9125D, Welch 4158, Braun 12720.
WE-34200	1/room	Weights: metric, hooked, solid metal, in wood block, 9 weights from 10 to 1000 grams, Cenco 9810, Welch 4194A.

Stock Number	Quan.	Description
BO-42125	1	Bookcase, District Drawing #40, approx. 48" long x 11¼" deep x 36" high, 3 shelves, 2 adjustable, lockable.
CH-10717	4	Chair, student, 17" seat height.
CH-10718	1	Chair, side, 18" seat height (for teacher).
CH-10097	38	Chair, desk, student, 17" movable.
DE-42165	1	Desk, teacher's, single pedestal.
ST-36130	1	Stool, steel, 30".
TA-10725	1	Table, demonstration, rollabout, District Standard #67.
TA-11200	1	Table, library, 30" x 60" x adjustable height 20" to 29".
TA-13000	1	Table, typewriter, wood, 18" x 32" x 29" high.

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Stock Number	Quan.	Description
BO-42125	1	Bookcase, District Drawing #40, approx. 48" long x 11¼" deep x 36" high, 3 shelves, 2 adjustable, lockable.
CH-10717	40	Chair, student, 17" seat height.
CH-10718	1	Chair, side, 18" seat height (for teacher).
DE-42165	1	Desk, teacher's, single pedestal.
ST-36130	1	Stool, Steel 30".
TA-10725	1	Table, demonstration, rollabout, District Standard #67.
TA-11950	20	Table, student, 2 pupil, 22" x 54" x adjustable.
TA-11200	1	Table, library, 30" x 60" x adjustable height 20" to 29".
TA-13000	1	Table, Typewriter, wood, 18" x 32" x 29" high.

Stock Number	Quan.	Description
CH-10718	1	Chair, side, 18", seat height (for teacher).
DE-42165	1	Desk, teacher's, single pedestal.
FI-40350	1	File, 5-drawer, letter size, with lock.
TA-10725	1	Table, demonstration, rollabout, dist. drwg. #67.
		Accessories for Rollabout Demonstration Table
	1	Upright rod assembly with metal crossbar, 19 mm.
	2	Aluminum adapters for 13 mm. rods.
	3	Hook collar for 19 mm. metal cross bar.

PROJECT ROOM
SCIENCE

Stock Number	Quan.	Description
BE-40200	1	Bench, work, approx. 2'6" x 5'0". Dist. Drwg. #6.
VI-77050	1	Vise, bench, swivel base, with anvil, 3½" jaw.

Stock Number	Quan.	Description
PR-65000	1/school	Projector, Filmstrip and Slide, combination, 2" x 2", Viewlex Mod V-25P.
PR-65200	1/school	Projector, motion picture, light weight, 16-mm RCA 400 Junior.
PR-65360	1/school	Projector, overhead, 10" x 10", level stage, tilt head, Thermo-Fax, Model 66.
ST-13450	1/school	Stand, projector, mobile 36" Pixmobile 1000-413A.
ST-13455	1/school	Stand, projector, overhead, mobile 26" Pixmobile #1000-415A.
CO-20510	1/school	Copying machine, Thermo-Fax, Courier, Model 270.
CA-74000	1/school	Cathode ray tube, Crook's, magnetic effect, Cenco 71555.
SO-30000	1/school	Solar energy demonstrations, Cenco 81090.
TH-28000	1/school	Thermometer, maximum-minimum, Taylor 5458, Turtox 376A285.
TH-29200	1/school	Thermostat, demonstration model, Cenco 77462.
WE-02950	1/school	Weather Bureau combination temperature, humidity, pressure, Edmund S90,043.
AN-20010	1/school	Anemometer, windspeed and direction on single dial indicator with battery, cable and direction, Braun 662-15, Taylor Windscope No. 3105.
		Revolving Equipment*
GE-42050	3/dist	Generator, audio kit, sinewave, 10CPSto100KC, Heathkit IG-72.
OS-09200	3/dist	Oscilloscope, kit, 5", wide range, 5 mc, Heathkit 10-12.
RA-14915	3/dist	Radioactivity demonstrator, with tube, Cenco 71201/71227.
TE-20025	3/dist	Telescope, portable, Questar.
CA-32280	1/dist	Camera for Questar.

*Available for circulation from Education Center

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (2 Rooms)

LIST Life Science Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Chart, Carlsen, Physiology, set of 30, 29 x 42" on white washable paper in solid charthead, round steel base on rollers	1/School	CH 12450	1	set
Hemacytometer, single improved Neubauer ruling, Levy, Cenco 40200 o/e	1/School	HE 47000	1	ea.
Hemoglobinometer, Haden-Heusser, Turtox 335A72	1/School	HE 55000	1	ea.
Hot Plate, electric, 1000 W, 115 V, single element, 3 heat	1/Room	HO 68000	2	ea.
Incubator, electric, room temperature to 56° with thermostat sensitivity 1/2° C., Welch 8352A o/e	1/School	IN 18000	1	ea.
Micro-projector, 100 watt, with mechanical stage and extra simple stand type, Swift Model No. S.B.W.-1 o/e	1/School	MI 09810	1	ea.
Microscope, binocular, 2x objective, 15x wide field eyepiece, simple stand type, Swift Model No. S.B.W.-1 o/e	5/School	MI 09625	5	ea.
Microscope, monocular, student, triple nosepiece with 4x, 10x, & 40x achromatic objectives, 10x eyepiece. Fixed condenser, iris diaphragm, with light source, without case, Olympus HS o/e	18/School	MI 09810	18	ea.
Microscope, monocular, student, triple nosepiece with 4x, 10x, 40x achromatic objectives, 10x eyepiece, fixed condenser, iris diaphragm, with plano-cave mirror, without case, Olympus Model HS o/e	1/School	MI09820	18	ea.
Microscope, monocular, large general purpose, triple nosepiece with 10x, 40x, and 100x oil immersion objectives, 5x, 10x, 15x periplane eyepieces, calibrated mechanical stage, substage condenser with iris diaphragm, equipped with attached light source, with case, Swift SMA o/e	1/School	MI 09830	1	ea.
Microscope Slide Set, Bontanical, 25 slides, Ward ExS250	4/School	MI 05000	4	ea.
Microsc Slide Set, Zoological, 25 slides, Ward ExS500	4/School	MI 05010		ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (2 Rooms)

LIST Life Science Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Aquarium, heavy metal frame, 15 gal. capacity, 24 x 12 x 12", Welch 8343B, Turtox 205A23 o/e	2/Room	AQ 10200	4	ea.
Aquarium, stainless steel frame, 8 gal. capacity, 18 x 9 x 11", Turtox 205A1350 o/e	2/Room	AQ 10100	4	ea.
Autoclave, pressure cooker, cast aluminum, approx. capacity 16 qt., 20 psi pressure gauge. Cenco 44125, Welch 5298 o/e	1/School	AU 50000	1	ea.
Balance, double beam trip scale with agate bearings. Metric maximum capacity 2,000 grams, maximum sensitivity 0.1 grams, Cenco 3560, Welch 4041D o/e	1/Room	BA 30000	2	ea.
Balance, triple beam, cap 111 grams, sensitivity .01 grams, complete with auxiliary weight to increase capacity to 201 grams, with plastic cover. Waco T526A, Welch 4030, Aloe V7450 o/e	4/Room	BA 30100	8	ea.
Bell Jar, high straight form, knob top, ground rim, approx. inside dia. 6", height 10", Cenco 14300B, Braun 14113 o/e	1/Room	BEL 2000	2	ea.
Bell Jar, high straight form, open top for rubber stopper, approx. inside dia. 6", height 10", Cenco 14305B, Braun 14145 o/e	1/Room	BEL 2010	2	ea.
Cage for small animals, all metal with rustproof finish, approx. height 14", width 18", depth 18", Cenco 44030 /e	2/Room	CA 14100	4	ea.
Cage for small animals, all metal, rustproof, approx. 9 x 9 x 15" sloping front, Turtox 220A495 o/e	2/Room	CA 14050	4	ea.
Cage for small animals, activity, all metal, rustproof 16 x 10 x 9", Turtox 220A525 o/e	2/Room	CA 14200	4	ea.
Centrifuge, hand operated, Turtox 375A515	1/School	CE 30930	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (2 Rooms)

LIST Life Science Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNI UNI
Microtome knife and back, AO Spencer #940 and 960 o/e	1/School	MI 11000	1	ea.
Microtome knife handle, AO Spencer #955 o/e	1/School		1	ea.
Microtome table, hand operated AO Spencer 900 o/e	1/School	MI 11010	1	ea.
Model, anatomical heart, enlarged, Turtox TM 436 o/e	1/School	MO 14300	1	ea.
Model, anatomical portable case, containing sexless torso and head, model ear, eye, and skin, Denoyer-Geppert Y100P o/e	1/School	MO 14390	1	ea.
Models, mitosis, animal, at least 8 stages, mounted, unbreakable materials, Turtox TM 10 o/e	1/School		1	ea.
Plankton towing net, Marine type, Mesh #12, Turtox 105A435 o/e	1/School	PLA 3000	1	ea.
Rack, test tube, 90 pin, Neoprene coated wire, rustproof pan, 19 x 18 x 7" deep, Braun o/e	1/Room 1/Prep.	RA 12001	3	ea.
Refrigerator, electric, 10 cu. ft., with freezer compartment	1/School		1	ea.
Skeleton, human adult complete, fully articulated, bleached bones with protective washable finish, with supporting rod and base, Walch 2K111, Turtox 14S1010 o/e	1/School	SK 20000	1	ea.
Sphygomanometer (blood pressure gauge), hook-type cuff, Cenco 43560, Aloe 10022 o/e	1/School	SP 39500	1	ea.
Support, camera, photo-micrographic, Cenco 65736 o/e	1/School	SU 60800	1	ea.
Teaching kit, physiology, Harvard App. Co. 1000 o/e	1/School	KI 71188	1	ea.
Terrarium top, sloping front, glass enclosed 12¼ x 18-3/8 x 5/8 to fit on and adapt the standard 8 gal. AAA aquarium	1/Room	TE 20250	2	ea
Timer, electric, Turtox 320A961	1/School	TI 41020	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (2 Rooms)

LIST Chemistry Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Balance, analytical, Chainomatic, with magnetic damper. Voland 220D o/e	1/School	BA 29900	1	ea.
Balance, double beam trip scale with agate bearings. Metric. Maximum sensitivity 0.1 gram. Max. capacity 2000 grams. Cenco 3560, Welch 4041D, Aloe V7502 o/e	1/Room	BA 30000	2	ea.
Balance, triple beam. Cap 111 grams, sensitivity .01 grams, complete with auxiliary weight to increase capacity to 201 grams, with plastic cover. Wac T526A, Welch 4030, Aloe V7450 o/e	8/Room	BA 30100	16	ea.
Barometer, Mercurial, elementary form, English and metric scales, with vernier indicator. Tube protected by metal body, mounted on wood or metal board. Cenco 76890-92, Welch 1215-1212F o/e	1/Room	BA 52200	2	ea.
Centrifuge, semi-micro, 110 v to hold 13 x 100 mm tubes Waco 3080 o/e	2/Room	CE 31000	4	ea.
Demineralizer kit, Chrystalab CL 5 o/e	1/School	DE 18500	1	ea.
Electrolysis apparatus. Hoffman H-tube form. Graduated tubes with glass stopcocks and platinum electrodes. Cenco 81200, Braun 27360 o/e	1/School	EL 28000	1	ea.
Fume hood, Kewaunee 2C 701R o/e	1/School	FU-31650	1	ea.
Hotplate, magnetic stirrer, Cenco 16632 o/e	1/School	HO-68300	1	ea.
Kit, compressed gases, consisting of 1 Cart, 3 tank capacity 1 Tank, 6-5/8" x 42" "OXYGEN" 1 Tank, 6-5/8" x 42" "HYDROGEN" 1 Tank, 6-5/8" x 42" "NITROGEN" Complete with regulator, connections, etc., Air Reduction Co.	1/School	KI-56200	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (2 Rooms)

LIST Chemistry Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Meter, pH, Metron, Coleman Model, Cenco 21730 o/e	1/School	ME-71815	1	ea.
Model Kit, Atom, Fisher-Hirschfelder-Taylor, Braun 49035 o/e	1/School	MO 20530	1	ea.
Power Supply Unit, portable. Variable low voltage AC and DC. Continuous current output at least 3 amps. Full wave rectification. Rheostat control, with circuit breaker or fuse, Welch 2606K o/e	1/Room	PO 91000	2	ea
Rack, test tube, 90 pin, Neoprene coated wire, rustproof pan, 19 x 18 x 7" deep, Braun 60996 o/e	1/Room	RA 12001	2	ea.
Shield for demonstration table, safety glass in steel frame approximately 30 x 40", with 2 cast iron bases. Braun 57260 o/e	1/Room	SH 24000	2	ea.
Table, Fume Hood, Kewaunee 20250 o/e	1/School		1	ea.
Weights, analytic, Class P, 1 to 50 g., stainless, Harshaw H3327 o/e	1/School	WE 33500	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL Each Senior High

LIST Common Equipment for Science

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Cart, stock, Colson 545 SR	1/Prep		3	ea.
Projector, 2 x 2, filmstrip and slide	1/Dept.	PR 65000	1	ea.
Projector, motion picture, light weight, 16 mm., RCA 400 Jr.	1/Dept.	PR 65200	1	ea.
Projector, overhead, 10 x 10", Transpaque, Jr.	1/Dept.	PR 65400	1	ea.
Stand, projector, mobile, 36', Plymobile	1/Dept.	ST 13450	1	ea.
Stand, projector, mobile, 26", Plymobile 1000-15 o/e	1/Dept.	ST 13455	1	ea.
Table, demonstration, rollabout, complete with upright rod assembly, District Drawing #67	1/Room	TA 10725	9	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL Senior Highs

LIST Physical/General Science

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Ballistic Car, Welch 742 o/e		BA 32000	1	ea.
Barometer, Aneroid, brass case, 5" dial, open center, English and metric scales, Welch 1239, Harshaw H3620 o/e		BA 52000	1	ea.
Cloud Chamber, diffusion type, with clearing field battery, Alpha and Beta sources, Atomic Lab In., Raymaster		CL 11000	1	ea.
Map, Polar aeronautical world (Trewartha) with meteorological diagram, 64 x 45", on spring roller with steel board, Nystrom WP96, mtg. No. 02 o/e		MA 61000	1	ea.
Map, U.S., natural regions (Atwood Regional-Political series) 52 x 55", mounted on spring roller with steel board, Nystrom AR1, mtg. No. 02 o/e		MA 61650	1	ea
Map, World, Political-Physical, 64 x 57", mounted on spring roller with steel board, Nystrom Ls98, Mtg. No. 02 o/e		MA 61831	1	ea.
Map, World, summer rainfall, winter rainfall (Atwood Regional-Political series) 52 x 62", on spring roller with steel board, Nystrom Ar 981, mtg. No. 02 o/e		MA 62000	1	ea.
Map, World, thermal regions, vegetation regions (Atwood Regional-Political series) 52 x 62", on spring roller with steel board, Nystrom Ar 982, mtg. No. 02 o/e		MA 62050	1	ea.
Model, automobile engine, plastic, 4 cylinder, with ignition system and transmission, Viking Importers o/e		MO 20000	1	ea.
Motor, Electric, St. Louis, two-pole armature between two bar magnets, dissectible, Cenco 79945, Welch 2450 o/e		MO 71500	1	ea.
Planetarium, Trippensee, hand driven, showing movement of earth, moon and Ve around sun, Cenco 58051, Welch 6876 o/e		PL 05000	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL Senior Highs

LIST Physical/General Science

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Pulley, Differential, chain-hoist, demonstration model, capacity 20 kg., Cenco 75707, Welch 780 o/e		PU 32000	1	ea.
Weights, laboratory, brass, metric, 13 weights in wood block.		WE 34000	2	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Acceleration Apparatus, 2 wheel metal car on inclined wire, Cenco 74975, Welch 817B o/e	1/School	AC 10000	1	ea.
Acceleration Apparatus, Packard, Cenco 74960 o/e	1/School	AC 10100	1	ea.
Ammeter, AC, portable, single range, 0-30 amp., Weston 528, Cenco 82654G, Braun 29652 o/e	1/School	AM 40000	1	ea.
Ammeter, DC, portable, single range, 0-3,amp, Cenco 82480B o/e	8/School	AM 40100	8	ea.
Ammeter, DC, portable, triple range, 0-1.5/3/30 amp., Cenco 82481A o/e	1/School	AM 40200	1	ea.
Amplifier, audio frequency, Heathkit o/e	1/School	AM 51000	1	ea.
Balance, double beam, trip scale, with agate bearings, metric maximum capacity 2000 grams; maximum sensitivity 0.1 gram, Cenco 3560, Welch 4041D o/e	8/School	BA 30000	8	ea.
Barometer, aneroid, demonstration, in all-glass air-tight base, with tubing, connection to permit control of inside pressure, dial in English and metric, approx. dia. 15 cm., Welch 1230 o/e	1/School	BA 52000	1	ea.
Barometer, mercurial, elementary form, English and metric scales with Vernier indicator, tube protected by metal body, mounted on wood or metal board, Cenco 76890-92, Welch 1215 1215-1212F o/e	1/School	BA 52200	1	ea.
Baroscope, without bell jar, Welch 1520 o/e	1/School	BA 54000	1	ea.
Bell Jar, extra high form, Cenco 14330, Welch 1483 o/e	1/School	BEL 1000	1	ea.
Boyle's Law Apparatus, with air thermometer, Welch 1083 o/e	4/School	BO 90000	4	ea.
Caliper. micrometer, metric, range 0-25 mm, with ratchet stop, Cenco 72655, Welch 40 o/e	8/School	CA 24000	8	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Camera Kit, Polaroid, including Camera, Mod. 95B; Winklight Mod. 252; exposure meter, Mod. 625 o/e	1/School	CA 32325	1	ea.
Centripetal Force Apparatus, Cenco 74470 o/e	1/School	CE 32000	1	ea.
Chart of Electromagnetic Radiations (Compton) 64 x 42", full color, with Teacher's Manual, Welch 4845	1/School	CHA 3000	1	ea.
Crookes Tube, to demonstrate fluorescence by the shadow effect, at least 22 cm. long, Welch 2144 o/e	1/School	CR 35000	1	ea.
Electrolysis Apparatus, Hoffman, H-tube form, graduated tubes, with glass stopcocks and platinum electrodes, Cenco 82100, Braun 27360 o/e	1/School	EL 28000	1	ea.
Electrophorus, large size and capacity; sulphur polystyrene or resinous, dielectric, approx. 24 cm. dia., Cenco 78675, Welch 1954 o/e	1/School	EL 30000	1	ea.
Electroscope, emanation, Welch 619	1/School	EL 30960	1	ea.
Electroscope, leaf type, large size, strong construction with large flat windows to permit projection, Cenco 78715 o/e	1/School	EL 31000	1	ea.
Fire Syringe, glass or metal cylinder, Cenco 77250, Welch 1725A o/e	1/School	FI 60000	1	ea.
Force Table, Kennon design, Welch 739B o/e	1/School	FO 55000	1	ea.
Galvanometer, portable, sensitivity approx. 20 micro-amperes per division, Weston 375, Cenco 82110, Welch 2732 o/e	9/School	GA 45000	9	ea.
Gas Laws Apparatus, wood plunger type, with jar, Cenco 76362-1450R o/e	4/School	GA 75000	4	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Generator and motor, demonstration, Miller-Cowan Dynamo Electric Machine, Welch 2408 o/e	1/School	GE 42000	1	ea.
Governor, fly-ball type (Watt's), with throttle regulating gear, to fit standard rotating head, Welch 929 o/e	1/School	GO 82000	1	ea.
Gyroscope, bicycle wheel type, with handles, Welch 975 o/e	1/School	GY 67000	1	ea.
Illuminator, optical disc, position fully adjustable, 100 watt, 115 volt projection lamp, Cenco 85264 o/e	1/School	IL 41000	1	ea.
Inclined Plane, adjustable, with height, length, and angle scales Cenco 75840, Welch 809 o/e	1/School	IN 16000	1	ea.
Induction Coil, dia. approx. 25 cm., 600 urns, No. 20 copper wire with flexible leads, Cenco 79745 o/e	2/School	IN 21000	2	ea.
Induction Coil, heavy duty, 4-10 v., primary, approx. 1" spark, external adjustable vibrator, Cenco 79800, Welch 2392A o/e	1/School	IN 21100	1	ea.
Induction Spheres, pair, Cenco 79091 o/e	1/School	IN 22000	1	ea.
Linear Expansion Apparatus, Cowan type, Cenco 77370 o/e	4/School	LI 47000	4	ea.
Linear Expansion Apparatus, Micrometer Form, Cenco 77410 o/e	4/School	LI 47200	4	ea.
Magdeburg Hemispheres, pressed steel, with threaded stopcock, approx. dia. 4½, Cenco 76731 o/e	1/School	MA 21000	1	ea.
Meter, lecture table, galvanometer, sensitivity 100 microamperes per scale division. Veltmeter ranges: 25 ma, 1 a, 5 a, 25 a. Scale approx. 32 cm. long, zero at center, Welch 2692 o/e	1/School	ME 71000	1	ea.
Metronome, spring driven, Cenco 73450 o/e	1/School	ME 72100	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Microphone, astatic, #54-M3 o/e (Radio Parts Co., San Diego)	1/School	MI 09401	1	ea.
Moment of Inertia Apparatus, Welch 572H o/e	1/School	MO 32000	1	ea.
Motor Generator, experimental, ring design, complete for 2-pole operation, with 2 special field coils, Welch 2460-2460A o/e	8/School	MO 72000	8	ea.
Optical Disk, Hartl, 30 cm. disk, with accessories and instructions, Cenco 85245, Welch 3675 o/e	1/School	OP 83000	1	ea.
Organ Pipe, metal, cylindrical, with sliding piston, length approx. 27", Welch 3272 o/e	1/School	OR 37000	1	ea.
Oscillator, audio frequency, Heathkit AO-1 o/e	1/School	OS 97999	1	ea.
Oscillator, Rotary, mechanical, Cenco 74565 o/e	1/School	OS 08500	1	ea.
Oscilloscope, Cathode Ray 5", Heathkit O-11 o/e	1/School	OS 09200	1	ea.
Parabolic Reflectors, pair, 25 cm. dia., mounted, Welch 1737 o/e	1/School	PA 71000	1	ea.
Pascal's Vases Apparatus, entire assembly mounted on base, integral dial-type pressure gauge, Cenco 76085, Welch 1023 o/e	1/School	PA 81000	1	ea.
Photometer, photoelectric (foot-candle meter) pocket type, range 0-75 foot candles, Welch 3588 o/e	1/School		1	ea.
Polaroid Experimental Kit, hand type, 2/4 cm., type II. Polaroid discs in hand polariscope, with various specimens. In pocket case with instructions, Cenco 87616, Welch 3703C o/e.	1/School	PO 51000	1	ea.
Power Supply Unit, portable, variable, 11 voltage AC and DC, continuous current output 3 amps., full wave rectification, Rheostat control, with circuit breaker or fuse, Welch 2606K o/e	8 /School	PO 91000	8	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL Senior High (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Power supply, DC, 0-32 volt, filtered 15 amp. continuous duty	1/School	PO 91500	1	ea.
Primary and secondary coil set, telescoping, with removable iron core, length approx. 20 cm., Cenco 79750 o/e	1/School	CO 15100	1	ea.
Pump, vacuum pressure, motor driven, minimum pressure 25 microns, maximum pressure 10# per sq. in. with 10" plate, mounted on base with 1/4 hp, 115 v, 60 cycle, AC motor, Cenco Pressovac 905-15, Welch Wegner 1410N o/e	1/School	PU 34400	1	ea.
Radioactivity Demonstrator "Classmaster," Welch 2156, Cenco 71220 o/e	1/School	RA 14900	1	ea.
Radio Outfit, short wave, demonstration, with two tubes and neon wand, Cenco 80435 o/e	1/School	RA 14950	1	ea.
Relay, pony telegraph, commercial form, 20 ohm coils, Cenco 80830 Welch 2626 o/e	2/School	RE 51000	2	ea.
Resistance Board to hold 4 or 5 wires 100 cm. long, Cenco 83100, Welch 2816 o/e	1/School	TR 81000	1	ea.
Resistance Box, plug type, 12 plugs, giving maximum of 111 ohms in 0.1 ohm stops, Cenco 82785 o/e	4/School	RE 81500	4	ea.
Resistance Box, Decade 1 to 9,999 ohms, Braun 2755A	1/School		1	ea.
Resistance Spools, mounted on base, set of 5 spools with binding screws, Cenco 83040, Welch 2820 o/e	1/School	RE 81700	1	set
Resistance Spools, set of 8 spools 0.5 to 1000 ohms, Cenco 83049 o/e	1/School	RE 81800	1	set
Resonance Tube, sodium - Welch 3715 o/e	1/School	RE 81975	1	ea.
Resonance Tube, large size 3.2 x 120 cm., graduated, Welch 3309	1/School	RE 81950	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Rheostat, lampboard, 5 socket, for Edison base lamps, Cenco 83035, Welch 2424 o/e	2/School	RH 29000	2	ea.
Rheostat, slide wire, 20-25 ohms, 4-5 amps., wound on ceramic or ceramic covered tube, approx. 30 cm. long, 5 cm. dia., smooth, positive contact, Cenco 82910-13, Welch 2751 o/e	1/School	RH 29500	1	ea.
Rod, bed, optical bench, 200 cm., graduated, Welch 3622 o/e	1/School	RO 30000	1	ea.
Rotator, hand operated, worm drive, Welch 909A o/e	1/School	RO 81000	1	ea.
Rotator, variable speed, friction drive; spindle axis, adjustable through 360 degrees, with adapters for attaching the usual rotating accessories. Revolution counter engaged at option of operator. Mounted on base with 115 volt, 60 cycle, AC motor of adequate power, Cenco 7435CA, Welch 904A o/e	1/School	RO 82000	1	ea.
Sonometer, 2 wire weight tension type, with set of 4 wires and 2-1-kilogram weight hangers, without weights, Cenco 85065, Welch 3352 o/e	1/School	SO 56000	1	ea.
Slide Rule, demonstration model, with A,B,C,CI,D,K,S,L, and T scales; length approx. 6-7", with screw eyes for suspending Keuffel and Esser #100 o/e	1/School	SL 32500	1	ea.
Spectrometer, prism and grating, Welch 3692/3692A, o/e	1/School	SP 19020	1	ea.
Spectroscope, grating, direct vision, adjustable slit, wavelength scale, grating replica in light-tight metal, mounted on tripod base, Welch 3693 o/e	1/School	SP 19000	1	ea.
Spirometer (seven in one apparatus), approx., 12 cm. dia., with stopcock and supporting base or lets, Welch 1522 o/e	1/School	SP 43000	1	ea.
Speaker, Electrovoice, SP8B o/e (Radio Parts Co., San Diego)	1/School	SP 18000	1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Stool, rotating, freely rotating seat and footrest assembly mounted on a stable base, height 18-26", Welch 570B o/e	1/School	ST 36300	1	ea.
Stopclock, electric, with minute hand and second hand; seconds scales in one-second intervals; dial dia. at least 12 cm.; for 115 V 60 cycle AC, Cenco 73414 o/e	1/School	ST 37000	1	ea.
Stopwatch, plain timer, 60 second dial in 1/5 second intervals crown control, single jewel, **Cenco** 73516 o/e	1/School	TI 41500	1	ea.
Stroboscope Kit, Macalaster Bicknell #2800	1/School		1	ea.
Thermo-electric magnet - Cenco 81040 o/e	1/School	TH 28100	1	ea.
Transformer, dissectible, demonstration, six removable coils to give wide variety of voltage ratios, one end of core removable, about 75 volts on 115 volt, 60 cycle AC, **Cenco** 80280 o/e	1/School	TR 36000	1	ea.
Transformer, high voltage, 15,000 volts, 60 ma, Cenco 803650 o/e	1/School	TR 36125	1	ea.
Transformer, variable voltage, 0-135 volts, maximum current 7.5 amps., rheostat control, air-cooled core, 1000 VA power on 115 volt, 60 cycle, AC, Cenco 80297A, Welch 2608D o/e	1/School	TR 36200	1	ea.
Tuning forks, sympathetic, with adjustable weights, Welch 3246 o/e	1/School	TU 56210	1	pr.
Voltmeter, AC, portable, double range 15-150 volts, Weston Model 528, Cenco 82652 o/e	1/School	VO 51100	1	ea.
Voltmeter, DC, portable, single range 0-15 volts, Cenco 82486B o/e	8/School	VO 51200	8	ea.
Voltmeter, DC, portable, triple range, 0-1.5/15/150 volts, Cenco 82486B o/e	1/School	VO 51300	1	ea.
Voltmeter, vacuum tube, Welch 2136B	1/School		1	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL SENIOR HIGH (1 Room)

LIST Physics Equipment

DESCRIPTION	RECOMMENDED ALLOWANCE	IDENTIFICATION NUMBER	NO.	UNIT
Weights, general laboratory, brass, metric, tall form, in wood block, 13 weights from 1 to 1000 grams, Cenco 9125D, Welch 4158	2/School	WE 34000	2	ea.
Weights, metric, hooked, solid metal, in wood block, 9 weights from 10 to 1000 grams, Cenco 9810, Welch 4194 o/e	9/School	WE 34200	9	set
Wheatstone Bridge, diamond form, Welch 2804 o/e	1/School	WH 24000	1	ea.
Wheatstone Bridge, slidewire form, Cenco 83191 o/e	4/School	WH 24100	4	ea.
Seleny Oscillating Electroscope, Welch 1973C o/e	4/School	EL 31010	4	ea.

SAN DIEGO CITY SCHOOLS

SCHOOL Senior High

LIST Physics Revolving Equipment (Shared by Schools)

Allowance: 1 for each three senior high schools in each region.

DESCRIPTION	IDENTIFICATION NUMBER
Alpha Ray Apparatus, Hoag, Welch 621A	AI 30850
Alpha Ray Track Apparatus, Cenco 71245	AI 30880
Ballistic Pendulum, Blackwood Form, Cenco 75425	BA 33000
Choke and Resonance Apparatus, Demonstration, Welch 2601B	CH 25000
Electro-magnetic Demonstration Set, Cenco 79835, Welch 2462	EI 29500
Interferometer, with Accessory Lamp, Michelson, Cenco 71857, 71859-26	IN 71580
Mechanical Equivalent of Heat Apparatus, Welch 1684, Cenco 77815	ME 30000
Microwave Optics Equipment, Cenco 80422, 80429-3, 80429-4, 80434	MI 11900
Nuclear Scattering Apparatus, Welch 615	NU 44000
Oil Drop Apparatus, Hoag-Millikan, Welch 620	OI 25000
Photoelectric Relay, Demonstration, Welch 2148G	PH 64500
Power Supply, Demonstration, Welch 2138	PO 90500
Power Unit, High Voltage, for Oil Drop Apparatus, Welch 620K	PO 91700
Radio Receiver, Demonstration, Welch 2620	RA 15000
Radio Transmitter, Demonstration, Welch 2621	RA 16000
Specific Charge of Electron Apparatus, Cenco 71264	SP 18300
Stop Clock, Electric 1/100 sec. Welch 824K	ST 37025
Stroboscope, 480 to 60,000 vib/min., Welch 2154	ST 52100
Ultrasonics and Sonar Demonstration, Cenco 71870	UL 10000
Voltmeter, for Oil Drop Apparatus, Welch 3087	VO 51150
Inertial Masses, Cylindrical, Cenco 75265	IN 23825
Support, Rotating, Ball Bearing, Cenco 75305	SU 61500